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## CONTENTS

	PAGE
Virus isolated from keratoconjunctivitis .....	
..... <i>E. Gallardo and L. H. Hardy</i>	343
Clinical vascular physiology of the eye .....	<i>W. F. Duggan</i> 354
The psychoneurotic factor in ophthalmology .....	<i>C. A. Bahn</i> 369
Studies on the infectivity of trachoma. XIII .....	<i>L. A. Julianelle</i> 378
Modified Ewing operation for entropion .....	
..... <i>J. E. Smith and A. A. Siniscal</i>	382
Correction of paralytic lateral-rectus palsy .....	<i>B. F. Payne</i> 390
Treatment of herpetic and dendritic ulcers.....	<i>F. O. Schwartz</i> 394
Convergence function in metabolism .....	<i>S. V. Abraham</i> 400
Hereditary cataracta caerulea .....	<i>O. Wolfe, I, and R. M. Wolfe</i> 404
Devices to aid refraction.....	<i>G. F. Harding</i> 407
Refraction clinic .....	<i>A. E. Sloane</i> 408

## DEPARTMENTS

Society Proceedings .....	411
Editorials .....	415
Book Notices .....	419
Correspondence .....	421
Abstracts .....	422
Pan-American Notes .....	440
News Items .....	441

For complete table of contents see advertising page V

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VIRUS ISOLATED FROM PEMPHIGUSLIKE  
KERATOCONJUNCTIVITIS\*†EDWARD GALLARDO, CAPTAIN (MC), A.U.S., AND L. H. HARDY, M.D.  
*New York*

The etiology of pemphigus vulgaris has not yet been definitely established. Urbach and Wolfram<sup>1</sup> inoculated blood serum and blister fluid from pemphigus intracerebrally into rabbits. Using the suboccipital route for injections, they observed encephalitic symptoms followed by paralysis and death in some animals. This was attributed to the presence of a filtrable virus. These authors also offered evidence to show that the blood serum of patients with pemphigus contained antibodies against the antigen present in the blisters of patients as well as in the brains of infected animals.

Fleck and Goldschlag,<sup>2</sup> not satisfied with their own results when using the same technique, had the opportunity of repeating the experiments with the personal assistance of Wolfram. Fluid from a pemphigus blister was inoculated into 11 animals, and nonpemphigus material into 23 control animals; three animals in each group developed paralysis and died. From this they concluded that the suboccipital route of intracerebral inoculation may lead to lesions in the central nervous system apart from the action of infectious agents, and that the immunity

test used by Urbach and Wolfram lacked specificity.

More recently Grace and Suskind<sup>3,4</sup> succeeded in repeatedly isolating a virus from the bullae of skin pemphigus. The method employed by these authors consisted in lowering the resistance of mice by irradiations with X rays previous to the inoculation of the infected material. Unfortunately, there are no data in their report to show the presence in convalescent or immune sera of specific antibodies against the virus recovered from the lesions.

Markham and Engman,<sup>5</sup> in a critical review of the works of Urbach and Wolfram and of Grace and Suskind, came to the conclusion that pemphigus vulgaris is not caused by a virus. Their contention was supported by a series of carefully controlled experiments in which no virus could be demonstrated, either by chorioallantoic-membrane inoculations or by intracerebral inoculations into mice and rabbits. Commenting upon the data advanced by different authors, Markham and Engman pointed out that most of the experimental inoculations with pemphigus materials have been made in rabbits, which are known to be the host of *Encephalitozoon cuniculi*. This protozoan parasite (not cultivable by aerobic or anaerobic methods) is the cause of latent infections of the central nervous system which may be lighted up by intracerebral

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†Aided by a grant from the Francis I. and Elizabeth C. Proctor Foundation.

inoculations with foreign material or by simple puncture. As to the agent described by Grace and Suskind, Markham and Engman believed it to be a virus originally isolated from rats by Woglom and Warren<sup>6</sup> but also pathogenic for mice.

The incidence of ocular pemphigus has been determined recently by Cowan and English.<sup>7</sup> From an analysis of 15,676 reports of blind persons in Pennsylvania, pemphigus was cited as responsible for blindness in 22 eyes, this ratio being much higher than that previously estimated.<sup>8, 9</sup> In a later communication Klauder and Cowan<sup>10</sup> reviewed the literature of pemphigus of the eye in its relation to pemphigus of the skin and mucous membranes. A study of this review reveals that there has been no unanimity of opinion as to the proper classification of cases, due, perhaps, to the difficulties of an early diagnosis. Although most ocular involvements are preceded or accompanied by manifestations of pemphigus elsewhere in the body (particularly in the oral mucosa), cases may be found in which there are only ocular symptoms. In Klauder and Cowan's series<sup>10</sup> the disease was limited to the conjunctiva in 5 of 12 cases.

So far as we know there have been no reports of attempts to recover an infectious agent from ocular pemphigus. The primary purpose of this paper is to report a case of cicatrizing keratoconjunctivitis, with symptoms resembling those of pemphigus, from which a virus was isolated on three different occasions. It is intended also as a suggestion of the value that certain laboratory procedures may have in the future study of similar cases.

#### CASE HISTORY

H. R. S., a white man, aged 50 years, a lawyer, born of American parents and

reared in New York City, had suffered from recurrent irritation of both eyes since 1914. At that time it was reported that there was "a cicatrix forming in the lower cul-de-sac of the right eye." Periodically since then the eyes have been irritable and congested.

#### *Summary of past history:*

1917—Vaccinated against smallpox.

1918—Wounded in the leg, where a mixed staphylococcus-streptococcus infection developed. The eyes became irritable and were treated for several weeks with silver nitrate and copper sulphate.

1927—A chalazion was removed from the lid of the right eye. Later in this year chronic meibomianitis and marginal blepharitis were diagnosed. Chlorine water and acriflavine drops were used. Smears and cultures were negative.

1927 to 1938—Ocular irritations frequently recurred. Cultures throughout this period revealed the occasional presence of Staphylococcus. Treatment at three different hospitals consisted chiefly of massage of the lids and expression of meibomian secretion.

1938—Vision, O.D. 20/20; O.S. 20/400. Slitlamp showed a mild limbal congestion with slight temporal pannus in the right eye and marked limbal congestion with a superficial ring of vascularization extending 1 to 2 mm. inward from the limbus in the left eye. Fluorescein did not stain the corneas. Corneal sensitivity was reduced. Meibomian glands were clear. All physical and laboratory examinations were negative except that the blood cholesterol had a value of 240 mg. percent and there was a moderate growth of hemolytic staphylococci. Diagnosis of bacterial allergy was made, and the use of staphylococcus toxin was recom-

mended. Series of injections started in July, 1938. During this period a herpes of the upper lid developed; the right eye became congested, painful, and discharged freely. The attack lasted about 10 days. Cultures were negative. With the disappearance of the herpetic skin lesion the right eye became almost clear. Two days later the irritation recurred and lasted another 10 days.

1939—In April an attack of herpes zoster intercostalis occurred, lasting one month. *Staphylococcus vaccines* (autogenous and pooled) were used throughout this year.

1940—In June, the left eye was operated on for symblepharon and a chalazion. A tentative diagnosis of trachoma was made. Neoprontosil was administered orally for several days to a total amount of 320 grains.

1941—The eyes were fairly clear. Another chalazion was removed. There was a recurrence of herpes labialis. Medical treatment with riboflavin, nicotinic acid, and thiamin continued throughout the year.

The patient was first seen by one of us (L. H. H.) on January 1, 1942. Since December 14th he had suffered from irritable, discharging eyes. He had been using hot compresses, 1:3,000 bichloride of mercury ointment locally, and sulfadiazine by mouth.

On examination both eyelids appeared inflamed, and there was a moderate amount of nonpurulent discharge from both eyes. The corneas were clear, and fluorescein did not stain them. The sensitivity was reduced in both. Marked limbal congestion was present, with pannus surrounding the entire cornea of each eye. The blood vessels extended 2 to 3 mm. over the limbus. The upper and lower fornices of both eyes were definitely contracted and filled with scar tis-

sue but the conjunctival mucosa between scars was smooth; there were only one or two areas of infiltration. No nodules, papules, or follicles were seen.

Scrapings and cultures from the conjunctivas and cultures of the meibomian-gland secretion were taken from both eyes, for animal inoculations, at different times during our study.

In consultation with Dr. Phillips Thygeson an attempt was made at differential diagnosis. The possibilities of trachoma, essential shrinkage of pemphigus, membranous conjunctivitis, and caustic burn were considered.

The patient had had treatments with copper sulphate and silver nitrate, but this seemed inadequate to explain the deep formation of scar tissue in both fornices. The several operations for chalazia which the patient had undergone likewise failed to account convincingly for the extent of the scarring. It is possible that an atypical trachoma was present in 1940, but the evidence was insufficient to justify such a diagnosis. There was no history of diphtheritic or other type of membranous conjunctivitis. In view of these findings, essential shrinkage of the conjunctiva was considered the probable cause, in spite of the lack of evidence of pemphigus lesions in the skin or mucous membranes.

In a consultation with Dr. Ludwig von Sallmann essentially the same observations were made after careful examination with the slitlamp.

The patient was given 3.6 to 4.8 gm. of sulfanilamide daily for 10 days. Local treatment consisted of irrigations with a buffered solution pH 7.2, bichloride of mercury 1:3,000 to the lid margins, hot compresses, and gentle expression of the meibomian glands. When last seen (September, 1942), the patient was comfortable, both eyes were quiet, and vision was 20/15 in each eye.

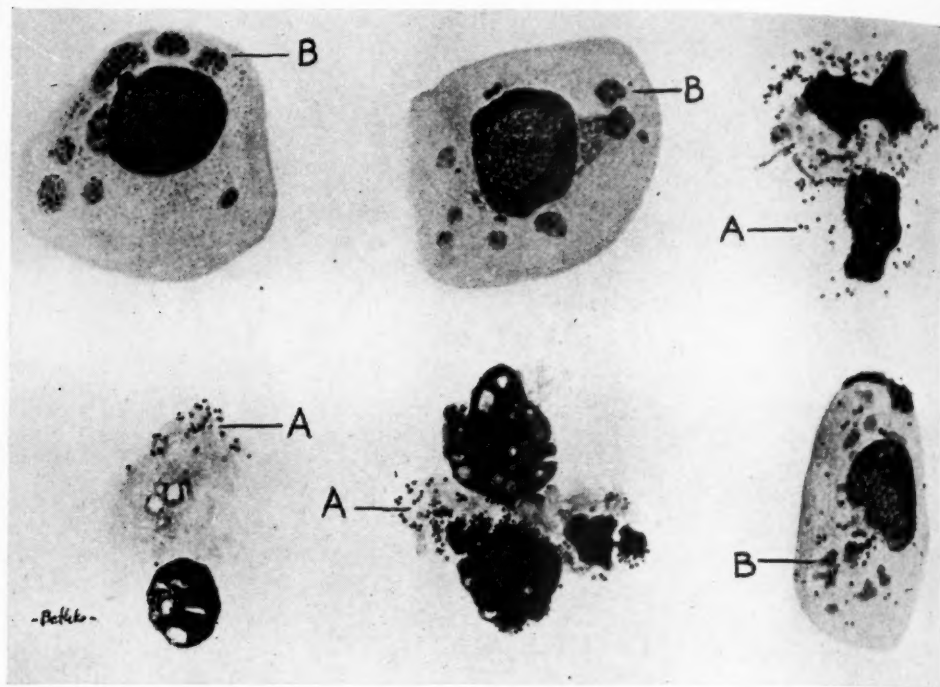


Fig. 1 (Gallardo and Hardy). Scrapings from infected corneas of rabbits, at the end of the third day. A, free elementary bodies (stained with Victoria blue), B, cytoplasmic inclusions (stained with Giemsa).

#### EXPERIMENTAL STUDY

A virus was first isolated from conjunctival scrapings of this patient on February 3, 1942; a second isolation was made 8 days later, and a third 80 days after the first. The material for study was taken always during a period of exacerbation of symptoms.

#### MATERIALS AND METHODS

The general procedure used in the three isolations was as follows: Scrapings from the conjunctiva were collected with a sterile platinum spatula and placed in small serologic tubes containing 0.3 c.c. of serum ultrafiltrate.<sup>11</sup> Blood-plate cultures of these mixtures demonstrated 20 to 30 colonies of coagulase-negative staphylococci in the first and second isolations. In the third were found 50 colo-

nies of staphylococci, of which a few were coagulase-positive and mannitol fermenters, and numerous pneumococci.

After a lapse of 30 to 40 minutes, required for the transportation of the specimens, one drop of the diluted scrapings was rubbed onto the scarified cornea of one or more rabbits, and 0.1 c.c. of the same material was transferred to the chorioallantoic membranes of chick embryos incubated 12 to 14 days. In the second and third isolations, in addition to rabbits and eggs, three adult Swiss mice were inoculated intracerebrally with 0.03 c.c. of the patient's diluted scrapings. All these mice died, manifesting symptoms that will be described later; subcultures on blood agar plates showed their brains to be free from bacteria.

From these primarily inoculated animals further passages were made to eggs,

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rabbits, and mice. For the purposes of this report the viruses from the first, second, and third isolations will be referred to as S1, S2, and S3, respectively.

**Rabbits.** The animals used were albino, and weighed between 3,000 and 3,500 gm. Two to three days after their corneas had been scarified with the patient's scrapings, as well as after successive transfers from eye to eye or transfers with other materials containing the virus, the corneas appeared nebulous and fluorescein stained them deeply. Chemosis together with ballooning of the conjunctiva and perilimbal infiltration was marked. A thin serous secretion was present after 24 hours and became thick and purulent between the third and fourth day. Numerous smears made during this period and stained with Victoria blue showed abundant free elementary bodies similar to those of vaccinia (fig. 1A). Cytoplasmic inclusions, morphologically identical with Guarnieri bodies (fig. 1B), were seen in slides of corneal scrapings

from two rabbits of group S1, three rabbits of group S2, and one rabbit of group S3. Most of the eyes were invaded by bacteria (predominantly *Staphylococcus aureus*) after the fifth day; plastic iritis, hypopyon, and in some instances panophthalmitis terminated the local picture. Skin inoculations of 0.1 c.c. of dilutions of the virus up to  $10^{-5}$  induced lesions consistently similar to the lesions of vaccinia.

Fourteen of 35 animals whose eyes were scarified with different materials infected with S1 and S2 died within 8 to 20 days (table 1), following rapid loss of weight and an indeterminate period of respiratory-tract infection. Encephalitic symptoms were observed in four of these animals two to three days before death. Autopsy revealed extensive inflammatory reaction with abundant polymorphonuclear leucocytes and numerous areas of necrosis in both lungs. Coagulase-positive *Staphylococcus aureus* and coliform rods were isolated from the lung

TABLE 1  
RABBIT CORNEAS SCARIFIED WITH MATERIAL FROM

Virus Isolation	Patient's Conjunctival Scrapings	Infected Rabbit Corneal Scrapings	Infected Mouse Brain	Infected Egg Membrane	Infected Rabbit Brain	Virus Recovered from Brains of Rabbits*
S1	$\frac{2}{2}$ FB	$\frac{6}{6}$ FB CI	$\frac{0}{2}$ FB CI	$\frac{6}{8}$	$\frac{2}{2}$	$\frac{1}{2}$
S2	$\frac{4}{4}$ FB	$\frac{8}{8}$ FB	$\frac{6}{6}$ FB CI	$\frac{8}{8}$ FB	$\frac{4}{4}$ FB CI	$\frac{1}{4}$
S3	$\frac{4}{4}$ FB	$\frac{6}{6}$ FB CI	$\frac{6}{6}$ FB	$\frac{4}{4}$	0	0
Number of animals inoculated	5	10	7	10	3	
Number of animals died	1	5	4	2	2	

\* Inoculated in the cornea with infected mouse-brain material.

Upper numerals = positives; lower numerals = inoculated.

FB = free elementary bodies found; CI = cytoplasmic inclusions found.

tissues. Of six attempts made, the virus was successfully recovered from the brain immediately after death in only two of the four animals in which symptoms of encephalitis were observed (table 1). The virus was subsequently maintained in rabbit's cornea, mouse brain, and on the chorioallantoic membranes of chick embryos. The potency of the virus in the last two tissues was kept almost unimpaired by storage at 4°C. for at least six weeks.

When virus S1 was isolated, there arose the question of the possibility of an accidental contamination of the rabbit's eyes with vaccinia virus or of an activation of a rabbit-pox virus. To test this possibility in the course of experiments with materials from the second and third isolations, eight rabbits were included as controls. Both corneas of each of these eight rabbits were scarified and intradermal inoculations made with brain material from normal mice which had been kept in the same room and under the same conditions as the infected mice. No significant lesions developed in these control animals. Furthermore, while conducting these experiments the corneas of some 20 rabbits were scarified with herpes virus under identical environmental conditions in the course of other unrelated work; in none of these were vaccinia or rabbit-pox infections encountered.

*Mice.* Dilutions up to  $10^{-3}$  of infected mouse or rabbit brain, inoculated intracerebrally in doses of 0.03 c.c., killed all of 42 adult white mice within six days. The symptoms in a large proportion of these animals were characteristic: flaccid paralysis of both posterior legs, accompanied by a fine tremor of the forelegs and body on locomotion, developed 24 to 48 hours before death. Signs of hyperexcitability were rarely seen, and no humped backs, which are typical of in-

fection with other viruses, were observed in any of the animals. Doses of 0.1 c.c., injected subcutaneously or intraperitoneally, killed 7 of 22 and 14 of 30 mice, respectively, in from 10 to 12 days. Virus was recovered by further passages from brain and spinal cord of six mice examined from each group.

*Eggs.* Direct inoculations of two eggs each with the first and second scrapings from the patient's conjunctiva produced typical foci resembling plaques of vaccinia at the end of three days of incubation. Since these first membranes contained a few staphylococci the lesions were believed to be nonspecific, but successive transfers from egg to egg reproduced the same foci in sterile membranes. Similar lesions occurred in eggs inoculated with sterile mouse or rabbit brain containing the virus. Individual foci measured from 4 to 8 mm. in diameter, merging in some areas (fig. 2), and the membranes were considerably thickened. On the other hand, the embryos appeared normal and of 18 examined in different experiments none showed pox lesions. In further passages from mouse brain to eggs, slides made from surface scrapings of 12 membranes showed free elementary bodies in 7 instances. After the third day of incubation the foci became more confluent, and hemorrhagic areas covered the whole membrane. The eggs used were from 12 to 14 days old. In five trials (four eggs each) with eggs 8 to 10 days old, it was noted that the embryos were highly susceptible to the virus, most of them dying after the second day of incubation. The dead embryos were always flooded with bacterially sterile serous-hemorrhagic fluid.

*Chicks.* Five chicks, six days old, were inoculated intracerebrally with the same doses employed for mice. All survived during 12 weeks of observation.

*Guinea pigs.* Six guinea pigs were in-

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oculated intradermally, and their corneas were scarified with infected mouse-brain material. The skin lesions were not necrotic and the indurated areas remained approximately one tenth the size of those obtained in rabbit's skin with similar doses. The corneas became slightly nebulous after the third day, but healed rapidly with very faint or no scars.

*Tissue cultures.* S3 mouse-brain virus,

and the tissues then centrifuged, ground, and diluted  $10^{-1}$  to  $10^{-5}$ . In all further passages supernatant fluids from  $10^{-3}$  to  $10^{-5}$  dilutions were used, both for tissue culture and mice titration. Five successive transfers made in this manner at three-day intervals gave fairly uniform results when tested intracerebrally in mice, six mice to each experiment. The symptoms in these animals were different from those

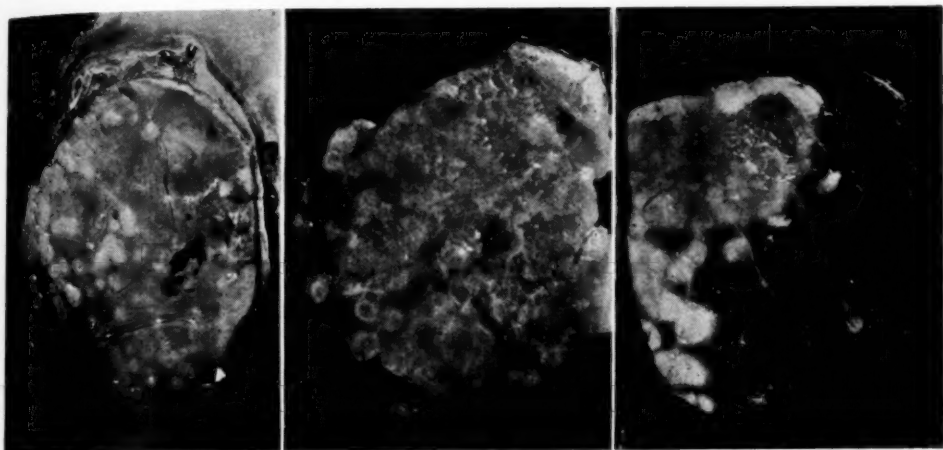


Fig. 2 (Gallardo and Hardy). Foci, resembling plaques of vaccinia, on infected chorioallantoic membranes of 14-day-old chick embryos, at the end of 72 hours of incubation.

diluted 1:100, was transferred in amounts of 0.1 c.c. to 4 chorioallantoic membranes of 14-day-old chick embryos. After further incubation at  $37^{\circ}\text{C}$ . for 48 hours, the membranes showing foci were ground and diluted  $10^{-1}$  to  $10^{-2}$ . Supernatants of these dilutions were inoculated, 0.1 c.c. each, into flasks containing 10 c.c. of ultrafiltrate<sup>11</sup> and minced chick embryo and into flasks containing ultrafiltrate and whole chorioallantois,\* as well as intracerebrally into mice in doses of 0.05 c.c. The flasks were stored in a temperature maintained at about  $4^{\circ}\text{C}$ . for 72 hours,

induced by inoculation with mouse-brain material. Irritability and hyperesthesia appeared after 42 hours, and all the animals died on the third or fourth day in convulsions.

Material transferred from the fourth tissue-culture passage into the skin of a rabbit gave definite but attenuated lesions within four days in dilutions up to  $10^{-7}$ .

*Neutralization experiments.* Three batches of fresh mouse-brain material infected with virus S1, S2, and S3, respectively, and a glycerolated mouse brain infected with Craigie's strain of vaccinia, were prepared under sterile conditions as follows: The brains were weighed and ground with fine sand in separate mortars and the pulps mixed with equal volumes

\*We are indebted to Miss E. Molloy of the Department of Bacteriology for her valuable suggestions and personal help in preparing the material for these cultures.

of ultrafiltrate and then centrifuged. Serial dilutions of  $10^{-1}$  to  $10^{-5}$  were made from the supernatant, and portions of each mixed with equal volumes of the following sera: patient (taken on second visit), normal nonvaccinated human, normal rabbit, vaccinia-immune rabbit, and S1-immune rabbit. These mixtures were

stored at  $4^{\circ}\text{C}$ . in the icebox for  $2\frac{1}{2}$  hours, at the end of which time they were transferred to chorioallantoic membranes of hen eggs. As a check on the preceding experiment, brains of mice and corneas and skins of rabbits were also inoculated with  $10^{-2}$  and  $10^{-3}$  virus dilutions plus S1-immune serum and normal rabbit

TABLE 2  
NEUTRALIZATION EXPERIMENT (EGG INOCULATIONS)  
VIRUS DILUTIONS

Sera	Virus	$10^{-1}$	$10^{-2}$	$10^{-3}$	$10^{-4}$	$10^{-5}$	Totals of $10^{-1}$ to $10^{-5}$ Dilutions
Patient	V	$\frac{2}{5}$	$\frac{0}{3}$	$\frac{1}{5}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{3}{13}$
	S1	$\frac{2}{6}$	$\frac{0}{4}$	$\frac{0}{5}$	$\frac{0}{4}$	$\frac{0}{3}$	$\frac{2}{15}$
	S2	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{0}{4}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{2}{12}$
	S3	$\frac{1}{4}$	$\frac{0}{4}$	$\frac{0}{4}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{1}{12}$
NH	S1	$\frac{3}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{1}{4}$	$\frac{0}{3}$	$\frac{11}{12}$
	V	$\frac{4}{4}$	$\frac{3}{5}$	$\frac{3}{4}$	$\frac{0}{4}$	$\frac{0}{3}$	$\frac{10}{13}$
NR	S1	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{2}{4}$	$\frac{1}{3}$	$\frac{0}{3}$	$\frac{10}{12}$
	V	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{2}{4}$	$\frac{1}{4}$	$\frac{0}{3}$	$\frac{10}{12}$
VR	S1	$\frac{2}{5}$	$\frac{3}{3}$	$\frac{1}{4}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{6}{12}$
	V	$\frac{2}{4}$	$\frac{1}{4}$	$\frac{0}{4}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{3}{12}$
S1.R	S1	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{0}{6}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{2}{15}$
	V	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{3}{17}$

NH=Normal nonvaccinated human; NR=normal rabbit.  
VR=Vaccinia-immune rabbit; S1.R=S1-immune rabbit; V=Vaccinia.  
Upper numerals=number of membranes with two or more foci.  
Lower numerals=number of membranes inoculated.

TABLE 3  
NEUTRALIZATION EXPERIMENT (ANIMAL INOCULATIONS)

Sera	Virus	Mice—0.03 c.c. Intracerebrally		Rabbits—1 Drop Scarified into Cornea		Rabbits—0.1 c.c. Intradermally	
		Virus Dilutions					
		10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>	10 <sup>-2</sup>	10 <sup>-3</sup>
S1.R	S1	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{0}{2}$	$\frac{0}{2}$	$\frac{0}{2}$
	S2	$\frac{2}{4}$	$\frac{0}{4}$				
	S3	$\frac{1}{3}$	$\frac{1}{3}$				
	V	$\frac{0}{3}$	$\frac{0}{3}$	$\frac{0}{2}$	$\frac{0}{2}$	$\frac{0}{2}$	$\frac{0}{2}$
NR	S1	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$
	V	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{2}{2}$	$\frac{1}{2}$	$\frac{2}{2}$	$\frac{2}{2}$

S1.R = S1-immune rabbit; NR = normal rabbit; V = vaccinia.  
Upper numerals = number positive; lower numerals = number inoculated.  
Positives were considered only those which developed typical lesions.

serum. The techniques described for vaccinia and other viruses<sup>12,13</sup> were adopted generally for the neutralization tests in eggs and mice.

The experiments in eggs showed that the patient's serum had about equal antibody titer against the S1, S2, and S3 viruses. This would indicate that the nature and origin of the three strains were probably identical. The neutralization of viruses S1, S2, and S3 by rabbit's S1-immune serum gives added support to this probability. It is clear from the results of this experiment that there was an antigenic relationship between the S virus and vaccinia. Further evidence of such a relationship was contributed by the partial neutralization of vaccinia virus with the S1-rabbit-immune serum (table 2).

The neutralization *in vitro* of the S virus by S-immune serum as shown by mouse and rabbit inoculations was significant, serving to substantiate the re-

sults on chorioallantoic membranes (table 3).

#### DISCUSSION

The findings in this case raise a number of interesting questions, most important of which concern the nature of the keratoconjunctivitis, the identity of the isolated virus, and the relationship of the virus to the disease.

(1) Since ocular pemphigus has no pathognomonic clinical or laboratory findings, it is obvious that the diagnosis, particularly in early cases, must be made with caution. However, the typical signs of the disease include progressive cicatrization and shrinkage of the conjunctiva, more marked in the lower fornices than in the upper, a progressive pannus with irregular vascularization differing from that of trachoma, a low-grade conjunctival eosinophilia, and bullous involvement of other membranes, particu-

larly of the mouth. The patient in this case had typical conjunctival and corneal changes but lacked conjunctival eosinophilia and involvement of other membranes. The importance of this latter finding in establishing a diagnosis is questionable: at the Institute of Ophthalmology two cases of ocular pemphigus of typical appearance and course but without associated mucous-membrane lesions have been seen since 1936, but in these as well as in six others with associated mouth lesions conjunctival eosinophilia was present.

In the past year four patients suffering from cicatrizing keratoconjunctivitis have been observed in whose cases trachoma could be excluded with reasonable certainty, but no causal agent could be found by ordinary bacteriologic study. None showed conjunctival eosinophilia but all four cases differed only in minor respects from those of typical ocular pemphigus. Unfortunately, no animal inoculations were made, but in the future such cases should be subjected to complete virus investigation. It would seem not unlikely that the pemphiguslike conjunctivides might form a heterogeneous group of varied etiology.

(2) The virus isolated in the present study certainly is closely related to vaccinia virus, although the clinical disease bore no similarity in appearance or clinical course to vaccinia.<sup>14</sup> Identity with vaccinia virus appeared to obtain in all respects studied except for the findings that cross-neutralization was not complete and that the lethal power of the S virus for rabbits was much higher than that shown by the New York City Board of Health's strain of vaccinia virus. The possibility that the virus was obtained as an accidental laboratory contaminant was ruled out by the three different isolations on rabbits and the two different isolations on the chorioallantois. Control rabbits did not develop the infection, and contamina-

tion of the chorioallantoic membrane would appear to be extremely unlikely.

(3) An etiologic relationship between the S virus and the conjunctival disease from which it was isolated might be presumed from the fact of repeated isolation and from the neutralization of the virus by the patient's serum. The value of this latter finding, however, is to a large extent negated by the fact that the serum also neutralized, though less completely (table 2), a known strain of vaccinia virus. The production of a severe keratoconjunctivitis in the rabbit, moreover, indicated only that the virus was virulent for these tissues, since the experimental disease differed in important respects both in appearance and course from the human disease. On the other hand, if identical findings should be demonstrated in other cases of this type, an etiologic relationship could be safely presumed. It is hoped, therefore, that this report will stimulate virus studies in all cases of keratoconjunctivitis of this nature.

#### SUMMARY AND CONCLUSIONS

1. A case of severe chronic cicatrizing keratoconjunctivitis with pannus, similar in clinical appearance and course to ocular pemphigus, is described. A presumptive diagnosis of ocular pemphigus was made on the basis of (a) the slow progressive cicatrization most marked in the lower fornices, (b) the periods of remission, and (c) the absence of follicles, inclusion bodies, or typical pannus of trachoma. The skin and other mucous membranes were not involved.

2. A virus, designated as S virus, close to if not identical with vaccinia virus, was isolated from conjunctival scrapings during three different periods of exacerbation of the disease. Typical elementary bodies and cytoplasmic inclusions like those of vaccinia were found.

3. The possibility of a laboratory con-

tamination with rabbit pox or vaccinia was considered but could be ruled out.

4. The virus was isolated both by rabbit-cornea and mouse-brain inoculations as well as by inoculation of the chorioallantois of the developing chick embryo. The close relationship to vaccinia virus was shown by neutralization tests in which vaccinia-immune serum neutralized the S virus and anti-S serum neu-

tralized vaccinia virus.

5. The relationship of the virus to the keratoconjunctivitis must remain an open question until observations on other similar cases become available.

We wish to acknowledge our appreciation to Dr. Phillips Thygeson for his advice and support in the preparation of this paper.

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## CLINICAL VASCULAR PHYSIOLOGY OF THE EYE\*

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### INTRODUCTION

In this era of modern medicine with its emphasis upon viruses, allergy, immunology, focal infection, shock therapy, and innumerable experiments upon healthy guinea-pigs and rabbits, it is worth recalling that Claude Bernard took the view that all experimental medicine is applied physiology.

In 1919, a British report mentioned that disease was so associated with positive agents (parasites, bacteria, toxins, and other activators) that it was difficult to believe in causation prefixed by a minus sign. Yet, such a concept led to the discovery and treatment of avitaminoses.

Only three years ago, Mellanby<sup>1</sup> stated: "When all disease came to be regarded as due to the invasion of the body by some form of *materies morbi*, the body itself was either forgotten completely or attention was mainly confined to the blood and its immunological powers." A year later, Sir Thomas Lewis<sup>2</sup> mentioned that there are three chief ways in which clinical progress is achieved. These are: (a) the discovery and identification of disease; (b) experimental work on clinical cases; and (c) the application of physiologic ideas and discoveries.

In recent years, Cannon's concept of homeostasis has helped us to understand reactions *within* the organism. Homeostasis is concerned with all the reactions that tend to maintain the normal *status quo* within the body. One example of homeostasis is the relation between the blood-sugar level, insulin, and epinephrine. A rise in the blood sugar stimulates the pancreas to liberate insulin; this

causes a fall in the blood sugar often to below normal. In turn, the adrenals pour out epinephrine, glycogen is liberated from the liver, the glycogen is hydrolyzed to glucose, the blood sugar rises, and the cycle recurs. Physiology is never static but always dynamic, and the normal is not a fixed mathematical value but a zone. When homeostatic reactions become permanently stabilized outside of this zone of normality, pathologic physiology begins. If pathologic physiology persists, pathologic anatomy develops. Changes in function and structure become manifest and clinical disease is present.

In the final analysis, every tissue in the body functions normally in virtue of an adequate oxygen supply. Each unit of tissue is supplied by an arteriole and a group of capillaries. In order that the blood may arrive at the capillaries, the arterioles must be patent. In order that the oxygen may reach the tissues, the capillary walls must have a certain normal permeability so that oxygen (derived from the oxyhemoglobin) can enter the tissues, carbon dioxide can enter the blood, and only as much water and salts diffuse out through the capillary walls as can be absorbed by these same capillaries. As Landis has shown, an adequate supply of *available* oxygen is probably the most important factor concerned in maintaining normal capillary permeability. When this permeability is increased beyond the physiologic "norm," plasma and cells pass into the perivascular tissues with resulting urticarial, purpuric, or nodular lesions. Since adequate oxygen is necessary for normal capillary function, and since the arterioles are the source of the blood by which the capillaries main-

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tain their normal permeability, it must be obvious that excessive arteriolar constriction can be a cause of pathologically increased capillary permeability.

It is my purpose to discuss certain ocular and extraocular lesions as manifestations of a failure of homeostasis. These lesions can be regarded as the result of certain vascular homeostatic reactions that are physiologic in nature but pathologic in degree. As a background, a short review of the physiology of the capillaries is necessary.

#### PHYSIOLOGY OF THE CAPILLARIES

The capillaries<sup>3</sup> are the ultimate units of the circulation whereby interchange of substances occurs between the blood and the individual tissue cells. Krogh determined that the capillaries are not passive tubes but that they can contract and relax independently of corresponding arterial reactions, and that the direct effect of arterial pressure on capillary dilatation is small and relatively unimportant.

The capillaries can be dilated and the arterioles constricted, as occurs when histamine is administered, or the arterioles can be dilated without corresponding capillary dilatation as occurs with acetylcholine. Under normal conditions the capillary walls permit the passage of water and crystalloids but not of blood cells, colloids, or plasma proteins. The fact that capillaries dilate and smooth-muscle cells contract when exposed to histamine indicates that the contractile elements of the capillaries are not similar to smooth-muscle cells.

Very little is known concerning the innervation of the capillaries. Although they seem to be influenced to some extent by vasomotor reactions, their delicate adjustment to the needs of the tissues is apparently independent of innervation.

While it has been known that stimulation of the posterior nerve roots causes

both arteriolar and capillary dilatation, Moon notes that Lewis believes that "the antidromic impulses do not directly stimulate the capillaries to dilate, but that the stimulation causes the tissue cells to release a substance (H-substance) which is a normal metabolite of the cells and which causes capillary dilatation. The immediate effect is local vaso-dilatation, congestion, and the formation of a wheal." Krogh endorses Lewis's hypothesis.

*Capillary reactions.* In 1902, Bayliss showed that carbon dioxide has a local vasodilator effect on capillaries. In 1917, Ebbecke concluded that functional hyperemia is produced by the reaction of capillaries to metabolites produced locally by functioning cells.

Krogh found that lack of oxygen caused capillary dilatation, whereas variations of acidity within normal limits was not an adequate stimulus. Landis found that lack of oxygen caused both capillary dilatation and increased capillary permeability. Lewis, on the other hand, believes that local metabolites having a histamine action account for these capillary changes.

Under the influence of small doses of pituitrin, the capillaries alone contract. Large doses also cause arteriolar constriction. Where capillaries had been rendered abnormally permeable and complete stasis had occurred, pituitrin (1/1,000,000) was unable to improve the capillary circulation. Here, an increase in arterial pressure only increased the capillary dilatation. The substance concerned in maintaining capillary tonus seems to be derived from the pars intermedia of the pituitary.

Krogh believes that the pituitary liberates a hormone causing capillary constriction and that this hormone is an important factor in the physiologic control of capillary circulation. Lewis believes that locally produced metabolites

account for functional and reactive hyperemia, whereas a hormonal agent, probably of pituitary origin, is responsible for their contraction.

*Direct responses of capillaries.* Direct pressure, if not too heavy, causes capillary constriction. Cooling causes an initial contraction of all skin vessels, but, if a temperature of 10°-20°C. is maintained for a few minutes, the capillaries and venules lose their tone and dilate whereas the arterioles remain constricted, and stasis results. Moderate heat dilates all vessels, but high temperatures cause the liberation of histaminelike substances, so that capillary dilatation and increased capillary permeability occur.

Caffein, guanidine derivatives, pituitrin, and, under some conditions, adrenalin cause capillary contraction, at least in the human skin. Large doses of adrenalin cause marked arteriolar constriction and a secondary capillary stasis.

Capillary dilatation results from many substances including arsenic, mercury bichloride and other metallic poisons, organic chemicals, anesthetic and hypnotic drugs, Heidenhain's lymphagogues of the second order, histamine, lack of oxygen, and many other substances that will be enumerated in the following section.

*Capillary permeability.* Normally, the capillary wall maintains the "water-balance" between blood and tissue fluid, due to its relative impermeability to the passage of colloidal material. The osmotic pressure of the plasma proteins is about 30 mm. Hg; the average intracapillary pressure is slightly above this, at least at the arteriolar end of the capillary. Normally, there is an increasing gradient of permeability from the arterial to the venous end of the capillary, counteracting the effects of a decreasing gradient of pressure. Arteriolar constriction lowers

capillary pressure; dilatation of arterioles elevates capillary pressure. In general, arteriolar constriction hinders filtration whereas arteriolar dilatation favors filtration. Loss of fluid from the blood occurs when the capillary pressure is raised by elevating venous pressure; venous congestion reduces to a minimum the absorption of extravascular fluid, since it elevates the capillary pressure above the colloid osmotic pressure of the plasma protein. Ordinarily the capillary wall is relatively impermeable to protein, although regional differences exist in various organs. Hormones and calcium also affect the movement of fluid and dissolved substances through the capillary wall as does tissue activity.

The capillary endothelium is said to be permeable when it permits the passage of colloidal dyes, plasma proteins, and blood cells into the tissue spaces. Physiologically, in most tissues, the endothelium retains at least 95 percent of the total plasma protein; pathologically, leakage of whole plasma occurs frequently and in voluminous amounts. In other words, the capillary endothelium changes quantitatively in its degree of permeability from time to time. In some lesions we find plasma, white cells, and red cells in the perivascular tissues. One other fact worth noting is that plasma leaves injured capillaries faster when the capillary pressure is high than when it is low.

Many substances have been shown to increase the flow of lymph by producing injury to the endothelium and increasing, pathologically, capillary permeability. Among these substances are: extracts of mussels, crayfish, intestinal mucosa, liver, and strawberries; bacteria, filtrates of bacterial cultures, tuberculin, diphtheria antitoxin, and various foreign sera; egg-white, ox-bile, emetin, pepsin, takadiastase; histamine, venoms, ethyl alcohol, and ether; urethane, paraldehyde, the

barbiturates, and salts of gold, platinum, arsenic, and mercury.

I have enumerated these substances at some length, because, in addition to the fact that they increase capillary permeability beyond physiologic limits, many of them are therapeutic agents much in vogue at the present time.

*The reaction to histamine.* The effect of histamine on the capillaries is typical of various substances of animal origin. When an infinitesimal amount is introduced into the skin, a red spot develops that gradually deepens to a bluish-red, surrounded by a bright-red zone. Gradually the deep-red central area swells, becomes pale, and develops sharply defined margins, contrasting markedly with the surrounding bright-red zone. This reaction is indistinguishable from wheals resulting from nettle-stings, mosquito bites, from foreign proteins introduced into a sensitized subject, and from acute urticarial reactions in general. Microscopically, the capillaries in the central red area are markedly dilated and engorged, the circulation through them is sluggish or in a condition of stasis, there is diapedesis of red cells into the tissue spaces, and acute edema is present due to leakage of plasma. The capillaries will not contract to sympathetic stimulation, adrenalin, or pituitrin. "The difference between the local and the systemic effects of histamine is one of distribution and extent."

It was Ebbecke (1917-1925) who stated that functional, irritational, and inflammatory edema are all due to the same mechanism; namely, metabolic products released from the cells when stimulated or injured. Ebbecke sensed a relationship between these phenomena and allergy, anaphylaxis, functional hyperemia, the action of Heidenhain's lymphagogues, inflammation, and shock.

These wheals are dependent upon blood

flow and cannot be elicited where the arterial supply is completely cut off. Venous congestion has no effect on the production of wheals. Fluid from wheals has a protein content approaching that of blood plasma; so they are not due to filtration but to increased capillary permeability. The local metabolite that causes whealing is called H-substance and it is closely related to histamine.

Recently, in discussing the fundus changes in essential cardiovascular hypertension, Tooke and Nicholls<sup>4</sup> recalled Ricker's theory. In 1927, Ricker stated that the underlying mechanism of both hypertension and inflammatory conditions is a neurovascular defect. Bacteria or other stimuli first set up a vasoconstriction of all terminal vascular segments. The capillaries rapidly become fatigued and relax, as following an overdose of adrenalin. Then a dilatation of the capillaries results associated with a sustained contraction of the arterioles, which causes a slowing of the capillary blood flow. Next, the capillaries become more permeable due either to anoxemia or to the opening up of stomata between the endothelial cells. Depending upon the degree of increased capillary permeability and the degree of slowing of the blood stream, there will be different types of exudate—plasma, white cells, or red cells classified by Ricker as prestasis, peristasis, and stasis, or liquor-stasis, leucostasis, and rubrostasis.

Liquor-stasis causes urticarial lesions, leucostasis results in such lesions as acute iritis, choroiditis, retrobulbar neuritis, and episcleritis, whereas rubrostasis causes purpuric lesions such as a retinal hemorrhages and some cases of disciform degeneration of the macula.

Nearly every ocular lesion can be interpreted as one of Ricker's stages of prestasis, peristasis, and stasis.

Ricker is probably correct in his as-

sumption of the arteriolar-capillary origin of most of the so-called inflammatory lesions, but probably incorrect in assuming that all have a neurogenic origin. Petersen has raised a similar objection to Ricker's theory.

#### FAILURE OF HOMEOSTASIS

Throughout life, various exogenous and endogenous factors regulate the tone of the arterioles so that normal capillary and tissue function results. Among these factors are adrenalin, sympathin, acetylcholine, the autonomic nervous system, thyroxin, pituitrin, the sex hormones, vitamins, oxygen, carbon dioxide, histamine, the pH of the blood and tissues, various metabolites, and sudden changes in the meteorologic environment. An over- or undersupply of any of these factors can cause clinical lesions that can be attributed to a failure of homeostasis. As a background, let us consider extraocular lesions due to excessive arteriolar spasm resulting from an oversupply of adrenalin and pituitrin.

Galgiani<sup>5</sup> and his co-workers gave inhalations of 1-percent epinephrine every 2 hours for 48 hours before death to a dying patient. At autopsy, an acute tracheitis with leukocytic and round-cell infiltration and loss of epithelium was found. The authors stated that prolonged vasoconstriction can cause tissue damage with secondary inflammatory reactions due to the anoxemia.

Keeney<sup>6</sup> reported the case of a man, aged 33 years, who received an injection of 0.5 c.c. of 1:1,000 adrenalin in oil. He developed a headache immediately and then became unconscious. When he was examined by a neurologist, he had a complete right hemiplegia and right homonymous hemianopia. Keeney attributed the results to either angiospasm or hemorrhage.

Dorwart's<sup>7</sup> patient collapsed after an injection of adrenalin. He showed signs of early shock with cyanosis of the lips, nailbeds, and palms.

Gormsen's<sup>8</sup> patient died a few moments after giving himself 60 mg. of epinephrine subcutaneously. At necropsy there was hyperemia of all the organs; microscopically, there were capillary and venous stasis, and edema and hemorrhages in the lungs.

Cohn<sup>9</sup> reported four cases in which injection of adrenalin in oil caused nausea, vomiting, chills, urticaria, cyanosis, dyspnea, and edema of the forearms.

Cohen and Waterstone<sup>10</sup> reported two cases in which the subcutaneous injection of regular adrenalin caused necrosis of the tissue at the site of injection. They compared the reaction to the Arthus phenomenon. The necrosis could have been due to excessive arteriolar constriction.

Likewise, Richter<sup>11</sup> recently reported a case of Hodgkin's disease in which the lymph nodes enlarged following injections of a procaine-epinephrine mixture. Repeated injections also caused an increase in the lymphocyte count of the blood. Richter concluded that Hodgkin's disease is not due to a specific organism or virus but that various organisms, their toxins, or products of metabolism are the exciting factors, and, more important, that a special reactivity of the lymph nodes is essential for the development of Hodgkin's disease.

Raab<sup>12</sup> believes that angina pectoris is due to anoxia of the cardiac muscle. He believes that effort, psychic emotion, and cold cause acute discharges of epinephrine from the adrenals, and that epinephrine exerts a specific anoxiating effect on the myocardium. He uses roentgen irradiation of the adrenals to prevent this myocardial asphyxia and re-

ports favorable results.

Moon<sup>8</sup> states the case for adrenalin very concisely. He says: "The evidence indicates that suitably large doses of adrenalin will produce a condition of circulatory failure indistinguishable from shock. . . . Adrenalin may produce maximal arterial constriction of such degree that the tissues suffer from anoxia. If the lack of oxygen is of sufficient duration and degree, atony of the capillaries and venules will develop in the areas affected. This will lead to . . . transudation of plasma and to stasis of blood in areas where maximal dilatation of the minute vessels has occurred." Cannon has endorsed this as a probable explanation of the circulatory failure following injections of adrenalin.

Krogh, Lewis, Ebbecke, Landis, and many others have shown that temporary deprivation of oxygen causes capillaries to become atonic and permeable to plasma. It must, therefore, be apparent that prolonged arteriolar constriction is one factor that can limit the supply of oxygen-containing blood to the capillaries so that they and the tissues involved suffer from lack of oxygen.

Moon has also noted that variation in capillary dilatation and permeability due to metabolites and hormones is a physiologic reaction but ". . . the accumulation of these substances . . . or their liberation in excessive amount . . . may produce catastrophic effects on the . . . circulation. But such effects are merely an enormous exaggeration of the normal physiologic purpose which these substances serve. To designate these substances as *toxic* requires a broad interpretation of that adjective so that it may include the exaggerated effects of hormonal substances."

Nedzel<sup>13</sup> injected varying amounts of pitressin into dogs and examined the

nervous system at intervals up to 30 hours. He concluded that there were transient spasms of the small vessels and that "the incidental regional anoxia damages the tissues to such an extent that alterations can be observed microscopically." He describes dilated capillaries, perivascular edema and round-cell infiltration, increase in glial cells, gliosis, swelling of the myelin sheaths, and changes in the nerve cells ranging from simple hydration to necrobiosis. All lesions were patchy, and invariably the pathologic patches were located where the blood vessels showed the greatest changes. He attributed all these changes to vascular spasm and the resulting capillary and tissue anoxia. The lesions he describes are strikingly similar to those of multiple sclerosis and infantile paralysis.

In dogs which received weekly injections of pitressin for more than a year, Nedzel observed that, in addition to the changes noted above, there was also thickening of the blood-vessel walls. Glial cells were more abundant and these were "practically always observed in close proximity to or in intimate connection with the small blood vessels." Again, the similarity to multiple sclerosis is striking.

Nedzel concludes as follows: "It seems logical to assume that if exaggerated spasm of the blood vessels can cause such visible changes in the spinal cord without the animal showing definite prolonged clinical symptoms, persons with unstable vascular systems who reveal only transient clinical symptoms involving the central nervous system will presumably also have similar microscopic lesions. Any number of factors—emotional excitement, remote trauma, infection, undue exercise, and particularly meteorologic alterations—which may occasion pressor episodes in the vascular bed of the central nervous system may lead to

definite pathologic changes in the tissue of the type herein described."

#### VASCULAR LESIONS OF THE FUNDUS

Thus far, systemic changes and extra-ocular changes attributable to arteriolar spasm have been discussed. In the shock syndrome, a majority of the capillaries and arterioles are involved. What about localized vasospasm? The most obvious example is closure of the central retinal artery or one of its branches.

##### *Spasm of the central retinal artery.*

Spasm of the central retinal artery or one of its branches is easily diagnosed. While some cases of closure are due to thrombosis and a few to emboli, most of the cases are of vasospastic origin. Because the spasm can be seen and because the loss of function (field defect) corresponds to the branch or branches of the artery that are in spasm, and because vasodilator therapy is often effective, no objection is raised against a primary vascular origin of the symptoms and clinical findings.

As may be recalled, in these cases, the fundus shows edema of the retina whose blood supply has been *suddenly* interrupted. There is also venous engorgement, and hemorrhages are not infrequent. In other words, Ricker's stages of prestasis and stasis are present.

Esterman's<sup>14</sup> case is of interest because he saw it 15 minutes after the attack began. Vision was reduced to perception of light, and the fundus findings were typical. Amyl nitrite and an injection of 200 mg. of sodium nitrite were given. Three minutes after the injection, all retinal arteries were filled and the retinal edema and macular blush had disappeared. A few minutes later, vision was found to be 20/20+ and the field was normal. As Esterman and others have pointed out, immediate treatment is es-

sential in these cases because the retinal ganglion cells degenerate if the blood supply is completely shut off for 30 minutes.

This condition can occur between the ages of 4 and 80. Emboli are rarely a cause, thrombotic occlusion is not uncommon in the arteriosclerotic group, while spastic occlusion is the *modus operandi* in all young patients and many older patients.

A prolonged spasm usually but not always results in permanent loss of sight. I recall one case of Dr. Arnold Knapp's in which the vision was 20/100 and only the superior nasal artery was patent. After an interval of about a month, the inferior nasal and inferior temporal branches also became patent and the vision improved to 20/20.

Also, Forster<sup>15</sup> reported a case in which the spasm had been present for five days before treatment with amyl nitrite was started. Vision improved from the ability to count fingers to 20/30.

These two cases show that much less oxygen is required to maintain the viability of the tissues than is necessary for normal function.

Among the alleged causes of closure of the retinal artery or one of its branches are: nicotine,<sup>16</sup> adrenalin and also ovarian insufficiency,<sup>17</sup> lactation,<sup>18</sup> cold air,<sup>19</sup> syphilis,<sup>20</sup> rheumatic fever,<sup>21</sup> mushroom poisoning,<sup>22</sup> quinine, toxemias of pregnancy, hypertension, epilepsy,<sup>23</sup> the removal of teeth,<sup>24</sup> and measles.<sup>25</sup> The last cause was reported by Parker Heath in 1931. The patient, a boy aged six years had an encephalitis following measles and bilateral closure of the central retinal arteries. His sight returned to approximately normal but his personality was so altered, due to encephalitis, that he was committed to an institution because of antisocial behavior. It is not unreasonable to assume that spasm of cerebral vessels

accounted for the encephalitis just as spasm of the retinal arteries caused the temporary loss of sight.

I have mentioned the etiologic factors in these cases to show that they are as many and as varied, and in some cases the same, as the so-called causes of acute retrobulbar neuritis, acute iridocyclitis, and acute choroiditis.

Thus far, we have mentioned cases of closure of the central retinal artery in patients who have relatively normal blood counts and hemoglobin. In these patients there is localized tissue and capillary anoxia due to arterial or arteriolar spasm. Anoxemia is not present.

However, instances of retinal-artery closure in patients who have an anoxemia due to hemorrhage must also be considered, for they are due to homeostatic reactions, normal in nature, pathologic in degree.

**Hemorrhage.** The classical signs of severe hemorrhage include tachycardia, small pulse pressure, lowered red-cell count and hemoglobin, pallor, thirst, muscular weakness, and shortening of the coagulation time of the blood. When shock occurs, there may be a temporary rise in the red-cell count. Certain homeostatic reactions occur following hemorrhage. These are: (1) tachycardia, so that blood whose oxygen-carrying power has been decreased circulates more rapidly; (2) a generalized vasoconstriction that maintains the blood pressure and that also shifts the blood from the skin and muscles into the general circulation so that more is available for the central nervous system and the "vital" functions; (3) a release of fibrinogen from the liver so that the blood clots more rapidly; (4) passage of fluid from the tissues into the blood to maintain the volume of circulating blood. (As I mentioned earlier, vasoconstriction seems to

favor absorption of fluid from the tissue spaces due to lowering of the capillary pressure, as occurs in hemorrhage.) This decreases the viscosity of the blood. (5) A swelling of the red blood cells; this increases the viscosity of the blood. (6) Finally, in some cases, one other change occurs; namely alkalosis. This is due to the fact that the need of the organism for oxygen in the presence of the decreased  $\text{CO}_2$ - and  $\text{O}_2$ -carrying power of the blood causes hyperpnea. Little or no more oxygen is taken into the blood, but the  $\text{CO}_2$  content is lowered, with a resultant rise of the pH. This alkalosis is distinctly unfavorable because it shifts the dissociation curve of oxyhemoglobin to the left, and less oxygen will be delivered to the tissues by a blood supply whose oxygen-carrying power has already been lowered by hemorrhage. The alkalosis in these cases is analogous to that occurring in cases of mountain sickness.

The tachycardia, generalized vasoconstriction, release of fibrinogen from the liver, and passage of fluid from tissues to blood are all normal homeostatic mechanisms, and all can be attributed to either sympathetic overaction, release of adrenalin into the blood, or, more likely, both. These reactions are the same qualitatively as those that constantly occur, differing only quantitatively from reactions in the normal individual, but still within physiologic limits. If, however, they pass quantitatively beyond the physiologic normal, shock occurs if all the arterioles and capillaries in the body are involved. Here the vasoconstriction is so intense that the capillaries suffer from acute oxygen lack, these capillaries dilate, their permeability increases, and plasma leaks out into the tissues. Suppose, however, that only a few arterioles show this excessive constriction; then, only the tissues supplied by these arterioles show

shock, and we have "shock in miniature," as Moon would say.

Amblyopia following hemorrhage was described by Hippocrates. Fries, Grout, R. Foster Moore, Arnold Knapp, and Barr have discussed the subject thoroughly. It has followed venesection, leeching, epistaxis, hemorrhage into the gastro-intestinal and genito-urinary tracts, and uterine hemorrhage. I saw one such case in a supposedly healthy donor.<sup>26</sup> Amblyopia can occur up to three weeks after hemorrhage, although in most cases it takes place during the first week. It is my impression that most of these cases occur in patients who do not go to bed but try to continue their daily activities after the hemorrhage. Since even moderate activity increases metabolism by 200 or 300 percent, and since CO<sub>2</sub> production will be similarly increased, it is obvious that hyperpnea probably causes alkalosis in these cases, and, with definite widespread arteriolar constriction, localized tissue anoxia could easily occur.

Fundus findings vary in these cases. The fundi may be normal, there may be papilledema, optic neuritis, closure of the central retinal artery, and/or retinal hemorrhages. Patients whose fundi are normal have a central scotoma, so the lesion is retrobulbar, but the basic pathology is probably the same as in cases of central-retinal-artery closure.

Amblyopia after hemorrhage, including closure of the central retinal artery, has been attributed to an unknown toxin, to autointoxication, and to the liver.

Many years ago, Leber stated that the ocular changes were produced not only through direct loss of blood but also through retardation of the circulation (stasis?) which resulted in edema and multiple hemorrhages in the retina. Goerlitz ascribed the condition to foci

of degeneration, probably thrombotic in origin, behind the lamina cribrosa.

Wolff<sup>27</sup> ascribed this type of amblyopia to spasm of the arteries due to lack of oxygen. Moore, in discussing Wolff's paper, mentioned that the unilaterality observable in some cases indicated a greater tendency to vascular spasm on one side of the body than on the other, as occurs in migraine.

Magitot<sup>28</sup> reported the unusual occurrence of blindness and deafness following hematemesis and melena. He compared the condition with quinine poisoning in which blindness and deafness are often associated. In the cases attributable to quinine, there is localized anoxia without anoxemia; in those due to hemorrhage, there is localized anoxia with anoxemia. In both we find arteriolar constriction.

Satanowsky and Bettinotti<sup>29</sup> have mentioned that the amblyopia due to optochin and the amblyopia following hemorrhage are due to arteriolar spasm.

Hartmann and Parfonry,<sup>30</sup> in discussing a case of amblyopia following hemorrhage, reported improvement from almost total blindness to 20/40 in each eye after the use of acetylcholine. They stated that the efficacy of vasodilator therapy indicated that vasoconstriction was the cause of the amblyopia.

In my opinion, the toxin responsible for the amblyopia following hemorrhage is a vasoconstrictor. Epinephrine is most probably the culprit. This increased output of epinephrine is due to homeostatic reactions set in action following the hemorrhage. The amblyopia, which is often due to closure of the central retinal artery, is due to reactions that are physiologic in nature but pathologic in degree. The lesion gives the picture of localized shock. Loss of sight rather than loss of life occurs. Similar vascular lesions account for the cases associated with papille-

dema, optic neuritis, and retrobulbar lesions.

MULTIPLE SPASMS INVOLVING THE  
RETINAL ARTERIES AND OTHER  
TISSUES OF THE EYE OR  
THE BODY

It is a well-known clinical fact that, when an individual has two or more distinct lesions, they are often due to one etiologic factor, and their mechanism of production is probably the same. Assuming that spastic closure of the central retinal artery or one of its branches can occur, it is not unreasonable to assume that, in patients suffering from so-called vasospastic diathesis, accompanying lesions are due to arteriolar spasm and the associated capillary changes of increased dilatation and permeability.

Tillé and Héry<sup>31</sup> and I<sup>32</sup> have reported cases of spasm of a branch of the central retinal artery coexistent with acute retrobulbar neuritis in the same eye. In both cases, the two lesions responded to vasodilator therapy.

Heath<sup>33</sup> reported spasms of the retinal arteries in 4 of 24 cases of juxta-papillary choroiditis.

Dejean<sup>34</sup> reported a case in which two attacks of angina pectoris were accompanied by transitory blindness of the right eye. During the third attack of angina, the vision of the right eye was lost permanently. Evidently a thrombosis occurred during the final attack.

Genet and Charpentier<sup>35</sup> reported a similar case in a young man who died. They stated that lack of acetylcholine, the vasodilator hormone of the body, might have been of etiologic significance.

In 1924, Shinkle<sup>36</sup> reported a case of Raynaud's disease or arteriospasm involving the feet, the heart wall, and the retina of the left eye in a woman, aged 44 years, who had undergone a thyroidectomy several years earlier. A period of

nervous stress preceded the attack. Subcutaneous injections of sodium nitrite resulted in a partial restoration of vision. This drug and sodium iodide were the *only* therapeutic measures that relieved the pain in the feet.

Bailliar<sup>37</sup> and Anderson and Gray<sup>38</sup> have also noted the occurrence of retinal artery closure in Raynaud's disease, and Schmelzer<sup>39</sup> reported a case in which closure of the central artery of the right eye occurred two years before signs of thromboangiitis appeared in the left leg.

In Mecca's case,<sup>23</sup> in a boy aged nine years, following a severe attack of epilepsy, almost complete blindness in both eyes ensued, due to closure of the central retinal arteries. Acetylcholine restored the vision to 0.25 and 1/10. Since the retinal vessels were visibly affected, the author concluded that the cerebral vessels were presumably affected.

Schousboë<sup>40</sup> reported that 57 percent of 53 patients suffering from angiospastic cerebral lesions had an accompanying retinal arterial spasm. Kravitz<sup>41</sup> has also noted the association of closure of the central retinal artery and a homonymous hemianopia.

Wagener<sup>42</sup> has mentioned that retinal arteriolar spasms occur both in the hypertensive toxemias of pregnancy and in the essential hypertension of nonpregnant patients. He noted that Mylius stated that retinal angiospasm preceded the retinitis in these cases.

Selinger,<sup>43</sup> in discussing toxemias of pregnancy and hypertension, stated that "spasms of the retinal arteries may be intermittent or continuous. . . . Only a segment of an artery or several large branches may be affected."

Reasoning by analogy, if there are spasms of the retinal arterioles in the toxemias of pregnancy, it is not unreasonable to assume that all other manifestations of these toxemias are also due

to smooth-muscle spasm. This would include eclampsia, hypertension, nephritis, vomiting, retrobulbar neuritis, hemianopias, and such disorders. These arteriolar spasms may be due to an increased hypersensitivity of the smooth muscle of the arterioles to pressor stimuli, to an increase or decrease of various hormones, to various metabolites, or to a combination of several factors. Some support for this theory is offered by Bryant and Fleming.<sup>44</sup> They added vasodilator therapy to the routine treatment in 120 cases of eclampsia. Only two deaths occurred and these were due to sepsis. They believe that abnormal arteriolar constriction is the only cause of eclampsia and that vasodilators are indicated in these cases. Hofbauer, who discussed their paper, stated that he used papaverine and nicotinic acid as *vasodilators* in similar cases. Furthermore, McGowan, Baker, Torrie, and Lees<sup>45</sup> reported two cases of vomiting of pregnancy that were relieved by the use of amyl nitrite and glycerol trinitrate. Here the spasm was located in the smooth muscle of the duodenum. A proposed therapeutic abortion was rendered unnecessary in each case.

Reports such as the two last named are of more than passing interest because treatment was based on the pathologic physiology present.

#### CHOROIDAL AND RETINAL LESIONS

The outer two thirds of the retina is nourished by the chorio-capillaris; the inner third of the retina is nourished by the retinal-artery system. It may be stated as an axiom that retinal vascular disease can occur in the absence of clinical manifestations of choroidal involvement, but that all choroidal vascular lesions involve the retina. In retinitis pigmentosa, due to lesions of the chorio-capillaris, the retina is involved. In acute exudative choroiditis, the nerve fibers

that pass over the choroidal lesion are always affected. In a lesion that I have called choroidosis centralis serosa<sup>46</sup> and that has often been diagnosed as central angiospastic retinopathy, the retinal changes are the most obvious but the least important of the clinical findings. The differential diagnosis is easily made by tangent-screen scotometry, because the defect for blue is always as large or larger than the defect for red.

These lesions of choroidosis centralis serosa are comparable to urticarial wheals behind the retina at the macula. They are the result of subretinal edema and correspond to Ricker's prestasis. Patients suffering from this disturbance complain of blurred or lowered central vision and micropsia. Transitory hyperopia is often found, and the retina is elevated at the macula.

Walsh and Sloan, Masada, Batten, Oguchi, Abe, and Riehm assign a primary choroidal origin to these lesions whereas Assayma, Horniker, Gifford and Marquardt, Cattaneo, Candian, and Junius attribute them to retinal angiopathy. I believe that both choroidal and retinal angiopathy can occur, and that the differential diagnosis is easily made from a consideration of the history, clinical findings, and tangent screen scotometry. Similar lesions occur in older patients. Here, the lesions are often larger and often complicated by transudation of blood into the wheal, giving the picture of stasis. Organization of the blood occurs, and the final lesion is known as disciform degeneration of the macula. Verhoeff<sup>47</sup> suggested this origin of the lesions in Kuhnt-Junius disease.

I believe that these central subretinal lesions can be interpreted as manifestations of vascular allergy. In 13 cases that I have seen, acute retrobulbar neuritis had occurred in 2 of the patients, acute exudative choroiditis had occurred in 1

patient, 1 patient had suffered from cutaneous urticaria, and 1 patient developed a Bell's palsy coincidentally with the ocular lesion, following exposure to cold. All patients showed more or less improvement after administration of only vasodilator therapy.

In 1925, Brown<sup>48</sup> reported that many ocular reactions occurred in 75 patients who received diphtheria antitoxin intravenously. Fundus changes included hyperemia of the disc and retina and elevation of the disc cup. The retinal veins and capillaries were dilated. In 20 percent of the patients definite papilledema developed and 10 percent complained of blurred vision. Brown concluded his article as follows: "The vascular reactions are perhaps the most striking and the most important concerned. . . . Hyperemia then must not be construed to indicate beginning inflammation of the disc but a marked vasodilatation [venous? (W. F. D.)] dependent on the serum reaction. . . . The direct action of the serum itself, as brought to the tissues, probably does not enter primarily into the ocular reaction. The primary response is a vascular one." Similar cases have been reported by Mason and Bedell. Theodore and Lewson<sup>49</sup> reported a bilateral iritis following the use of anti-pneumococcus serum. Was this a vascular lesion in the uveal tissue? I believe it was. The histamine theory of allergy and anaphylaxis adequately accounts for these vascular lesions as manifestations of allergy.

Many cases of multiple sclerosis are associated with retrobulbar neuritis. A few cases have been reported in which there were peripheral-fundus lesions due to choroiditis. Geserick<sup>50</sup> reported a case of multiple sclerosis which also had—not retrobulbar neuritis and not choroiditis but—repeated spasms of the retinal arteries. Is it not likely that all the mani-

festations of multiple sclerosis are due to vascular dysfunction and that repeated spasms of arterioles explain the symptoms and clinical findings?

#### INSULIN, DIABETES, SHOCK THERAPY

In the early paragraphs of this article, I mentioned that the relations between the blood sugar, insulin, and epinephrine afforded a good example of a homeostatic mechanism. This section of my paper returns to a discussion of this reaction.

The ophthalmoscopic picture of diabetic retinitis is too well known to require a detailed description. As Agatston<sup>51</sup> has mentioned, this is essentially a capillary disease, although arterioles and veins also show changes. Presumably an uncontrolled hyperglycemia prior to the administration of insulin therapy is partly responsible for these lesions. Yet, when these same patients are stabilized with insulin, the fundus lesions often do not improve and sometimes become worse.

The respiratory quotient of nervous tissue is unity. This indicates that glucose is being oxidized. Both glucose and oxygen are necessary. In the hyperglycemia of diabetes, glucose is abundant, but the insulin necessary for complete oxidation of glucose is lacking, and lesions of the retina occur. In a rigidly controlled case of diabetes, glucose is present and insulin is available but arteriolar constriction occurs, due to the homeostatic liberation of epinephrine secondary to the fall of blood sugar. This decreases the availability of oxygen for the tissues by obstructing the flow of blood to the capillaries, and tissue anoxia occurs. I mention this because all of the pathologic lesions produced in nervous tissue by insulin are similar to those produced by oxygen deficiency. Weil attributes these lesions to "intracellular anoxemia." Because of the insidious lesions produced by overdoses of insulin in diabetic patients, Wilder<sup>52</sup> re-

cently said: "... accumulated experience has led me to the opinion that the control of diabetes with insulin should be less rigid than heretofore has been demanded." Dibold and Falkensammer<sup>53</sup> also have stated that insulin therapy does not aid in the treatment of wounds in diabetics and they believe its use is contraindicated in cases of vascular damage. They found that padutin was valuable in controlling vascular disorders in their cases. Redslob<sup>54</sup> found that acetylcholine halted the progress of a circinate retinitis. I treated one case of diabetic retinitis, in which vision was 20/100 and 20/30, with vasodilators. After 18 days the vision was 20/40 and 20/25, and the fundus lesions showed some decrease in size.

Elwyn<sup>55</sup> has mentioned that the retinal vascular changes in diabetes can be regarded as forms of Ricker's states of prestasis and stasis. He also notes that a chronic state of subnutrition and of deficient oxygen supply is probably related to the consequent appearance of hyaline and lipoid deposits. He suggests *local* circulatory disturbances as the cause of diabetic retinitis, and, what is most important, suggests that in diabetes there is loss of stability of the mechanism concerned with maintaining the physiologic norm. This is a failure of homeostasis.

Insulin shock can produce changes in the normal eye. Schmidt<sup>56</sup> reported hyperemia of the retina and choroid and loss of tone of the external ocular muscles. These changes were not permanent. Cavka<sup>57</sup> reported blepharospasm, conjugate deviation of the eyes, mydriasis, narrowing of the retinal arteries, dilatation of the retinal veins, and blurring of the optic discs following both insulin and metrazol shock therapy. Many of the insulin cases also showed an increase in intraocular pressure. During insulin shock, Powell, Hyde, and Russel<sup>58</sup> observed constriction of the retinal arteries and en-

gorgement of the retinal veins, haziness of the vitreous, and an increase in intraocular pressure. They noted that some of the results of insulin hypoglycemia are due to epinephrine which was "stimulated into action by the insulin."

If such changes can occur in normal eyes after the injection of large doses of insulin, it is not unlikely that, in the eyes of diabetic patients, having diseased blood vessels, exudates, and hemorrhages, even doses of insulin which "control" the diabetes may hinder healing, especially since repeated small doses of insulin produce more damage in nervous tissue than does a single large dose.

All types of shock therapy induce anoxia of the brain and/or spinal centers. Anoxia is never desirable. All shock therapy acts by producing what Graves<sup>59</sup> calls a "diphasic vascular variation reaction." The first phase is one of vasoconstriction; the second phase is one of vasodilatation. All of the deleterious effects are due to the first phase, a phase of anoxia or anoxemia. The beneficial effects are due to the second phase of vasodilatation—if the patient survives the first stage.

#### SUMMARY

A number of retinal and other lesions, the results of homeostatic reactions that are physiologic in nature but pathologic in degree have been discussed. Many of these lesions have been attributed to toxins, viruses, foci of infection, and allergy. All can be interpreted as due to variations in the arterioles and capillaries that differ quantitatively from the normal. In most of the cases, the causes are endogenous and can be summarized by the words of Horder,<sup>60</sup> who said: "What was disease but a state of morbid physiology? The functions by which a man lived in health were the same as those through which he expressed his pathologic state. . . ." One

exogenous cause that is worthy of attention is a sudden change in the meteorologic environment. Petersen<sup>61</sup> mentions that vascular spasms are prone to occur following these changes and then says "... the lability of the vascular mechanism can certainly be best visualized by the ophthalmologist and should, in consequence, be most thoroughly appreciated by him, though actually when one searches the ophthalmological literature for the recognition that the 'eye patient' has any relation to an environment which must constantly condition his vascular reactions, there are but few papers to be found."

Animal experimentation can contribute little or nothing to an understanding of most of the lesions I have discussed. What is necessary is a wider application of physiologic ideas in interpreting disease pictures and in planning treatment, for treatment also must have a sound physiologic basis.

### CONCLUSIONS

More than 2,000 years ago, Hippocrates said: "So in one place the blood stops, in another it passes sluggishly, in another more quickly. The progress of the blood through the body proving irregular, all

kinds of irregularities occur."

In 1934, Petersen<sup>62</sup> said: "We are accustomed to regard the blood supply to the tissues as uniformly adequate unless gross pathological disturbances exist. It is true that we may regard the condition of the superficial vessels as of diagnostic aid when we observe either pallor or cyanosis or note the temperature of the superficial layers of the body. But in general we assume that in the normal individual all tissues are adequately supplied and clinically we seldom consider the possibility of regional or organ inadequacy of vascular function unless the clinical manifestations are obvious, as in Raynaud's disease or the related disturbances.

"As a matter of fact, variation in the oxygen supply to the tissues is probably one of the most common of events and dysfunction and inadequacy of the mechanism that has to do with oxygen supply is probably the fundamental cause of disease."

Everything that has here been stated was summarized adequately by Hippocrates. Petersen expresses the same idea more elaborately and more elegantly. Both writers are concerned with the variability of reactions in the organism.

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# THE PSYCHONEUROTIC FACTOR IN OPHTHALMIC PRACTICE\*

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Although patients consult physicians primarily for the relief of their symptoms, these may be markedly out of proportion to the actual organic findings. In an attempt to evaluate the functional element in ophthalmic practice, I reviewed a series of 400 consecutive office patients, 215 men and 185 women. Obviously these patients presented a number of organic ophthalmic conditions, which are shown in table 1. In my opinion a psychoneurotic factor that was capable of effecting symptomatic recovery existed in 301 cases. If, in a representative ophthalmic practice, the symptoms caused by organic disease of any sort is aggravated by the functional disorders in 75 of every 100 patients, then the proper management of the psychoneurotic component is of much greater importance than is commonly supposed.

"At least one-half of the patients seen in general practice have illnesses which are in part psychoneurotic. Some authorities have estimated that the psychoneuroses are among the most common of all illnesses. Most of the illnesses reported cured by quacks, and by means of diet fads, patent medicines, and faith cures belong to the general group of psychoneuroses."<sup>1</sup>

Several causes are responsible for the higher rate (75 percent) of neuroses in ophthalmic practice: (1) Efficient sight necessitates greater coördination of both automatic and conscious neuromuscular mechanisms than any other special sense. Generally speaking, vision is the most important sense involved in sustained effort

of practically every sort. (2) Accurate visual-function tests, such as retinoscopy, perimetry, and subjective testing for glasses, reveal automatic imbalances and fatigue reactions more readily and accurately than is possible elsewhere in the body. (3) The visual mechanism is the

TABLE 1  
OPHTHALMIC CONDITIONS PRESENTED  
IN 400 CASES

Diagnosis	No. of Patients
Slight (-1.00 D.) or moderate (-2.00 D.) myopia	34
Slight (+1.00 D.) or moderate (+2.00 D.) hyperopia	64
Very slight (-0.25 D.) astigmatism	32
Migraine	4
Tabes	2
Orbital neuralgia	2
Slight increase in ocular tension (normal central and peripheral field)	14
Lens opacities	2
Lens dislocation	2
Blepharoconjunctivitis	17
Keratitis, slight, virus	11
Episcleritis	2
Iridocyclitis	6
Head injury	2
Exophthalmos	1
Retinal arteriosclerosis	3
Nystagmus	2

most highly specialized and sensitive organ in the body. Thus, the corneal epithelium is the most pain-sensitive part of the body. (4) Functional nervous disorders, such as psychasthenia, hysteria, migraine, and others are more frequently manifested in the visual mechanism than in any of the other special senses.

A patient who has a greater neurotic element experiences more pain from an ocular foreign body than would a less neurotic patient from the same foreign body. A slight refractive error, especially an astigmatic one, causes more symptoms as the psychoneurotic factor increases. Since

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the threshold for nervous stimuli is lowered, the necessary amount of accommodation, convergence, and other visual activity requires more conscious effort.

We speak of our patients as being neurotic or not neurotic as we speak of oil

TABLE 2

RATIO OF ORGANIC FACTOR TO THE PSYCHONEUROTIC FACTOR IN THE SYMPTOMS OF 200 CONSECUTIVE OFFICE PATIENTS, MINOR INJURIES EXCLUDED

1. The psychoneurotic factor is 3/4 or more in 50 patients.  
(Psychoneurotic factor—4)
2. The psychoneurotic factor is between 2/4 and 3/4 in 20 patients.  
(Psychoneurotic factor—3)
3. The psychoneurotic factor is between 1/4 and 2/4 in 80 patients.  
(Psychoneurotic factor—2)
4. The psychoneurotic factor is 1/4 or less in 50 patients.  
(Psychoneurotic factor—1)

and water—two things that do not mix. If the patient's symptoms far exceed the organic causation, we too often assume that the patient's complaint is entirely imaginary. This is seldom, if ever, true. Autonomic nervous imbalances, which we call psychoneurosis, act as an aggravating factor of varying proportions. The organic factor, however, is measured subjectively by the amount of symptoms that would be induced in a person who has a reasonably stable autonomic nervous system. Together, both the functional and organic factors represent 100 percent of the patient's total symptoms. Each may range from 1 percent to 99 percent of the total 100 percent. Obviously, a somewhat elastic yardstick must be used to separate the functional from the organic components in any given patient. The functional component varies with race, constitution, and past and present environment. From a practical standpoint, however, its evaluation after a little practice is quite simple. By reviewing the patient's daily activities and putting oneself in the patient's place,

it is usually easily possible within a few weeks to evaluate and separate the functional and organic elements in any given patient. As shown in table 2, even a rough estimation which intelligently evaluates the patient's symptoms enables the ophthalmologist to treat more adequately the functional and organic elements.

### SYMPTOMATOLOGY

Almost every ophthalmic symptom or any combination of symptoms may have a psychoneurotic element (table 3). The

TABLE 3

FREQUENCY OF OCULAR SYMPTOMS IN 200 CONSECUTIVE PATIENTS WHO HAD A PSYCHONEUROTIC FACTOR

Ocular Symptoms	No. of Patients
Visual disturbances	32
Sensory	58
Secretory	2
Motor	0
Visual and sensory	56
Visual and secretory	2
Sensory and secretory	28
Sensory and motor	6
Visual, sensory, and secretory	16

psychoneurotic factor is most frequently manifested by:

#### I. Visual disturbances

A. Amblyopias or poor vision without sufficient objective explanation; psychasthenia, hysteria, occupational neuroses, migraine, and so forth

B. Entopic changes: muscae volitantes in psychasthenia, and so forth

C. Altered light and color adaptation: night blindness in war, psychasthenia, hysteria, and other neuroses

D. Visual hallucinations

#### II. Sensory disturbances

A. Pain, interpreted as itching, burning, pulling, sticking, and aching of all intensities, in and about the eyes. Frequently associated with extraocular symptoms as in the gastrointestinal neuroses

B. Abnormal tactile and heat sensitivity: infrequent.

### III. Vasomotor and secretory disturbances

A. Increased or decreased blood supply

1. Blepharoconjunctivitis without adequate organic causation, as in accommodative and muscular asthenopia
2. Swelling: palpebral, orbital, conjunctival, and possibly intraocular; focal or diffuse, with or without hemorrhage, as in urticarias, allergies, hyperthyroidism, and so forth. Glaucomatous attacks not infrequently follow fright or other emotional disturbances
3. Pallor: palpebral in fright; retinal in angiospasm and migraine

B. Lacrimation: with or without inflammatory reactions

### IV. Motor disturbances

A. Spasms: tonic or clonic; blepharospasm

B. Weakness: including paralyses of any part of the extraocular and intraocular musculature, as in hysteria

1. Extraocular muscles, singly or in groups; ptosis, convergence paralyses, and so forth; hysteria
2. Intraocular: accommodation; psychasthenia, hysteria.

To relieve the patient's symptoms it is obviously necessary to understand his background and development. A detailed history should therefore include: 1. *Present ocular symptoms*: visual, sensory, vasomotor, secretory, motor disturbances. 2. *Past ocular symptoms*: previous eye diseases, congenital abnormalities, hereditary tendencies, and accidents. 3. *Present and past extraocular symptoms*: (a) daily health habits—eating, sleeping, working, exercise, recreation, elimination, outlook

on life, use of stimulants; (b) subjective and objective symptoms suggestive of bodily system diseases.

From this type of history it is usually possible to estimate with reasonable accuracy the patient's hereditary background, and many of the environmental factors responsible for the psychoneurotic manifestations. Practically everyone has had an appreciable psychoneurosis at some time or another, often following some crisis in his life. During the transition periods, puberty and menopause, nervous-imbalance manifestations are more frequent and severe. In some organic diseases, such as Graves's disease, the psychoneurotic element is disproportionately high, whereas in others, such as tuberculosis, it is relatively absent. Because of the character of his work, the physician probably has a mild psychoneurosis more frequently than those engaged in business and other professions.

### TREATMENT

The separate treatment of functional and organic components in all the psychoneurotic patients is essential to success. Only too often both the health adviser and the patient indiscriminately confuse the organic and the functional factors of the patient's ailment. The patient is convinced that all of his symptoms indicate a serious organic defect about which little is really known. The fact is not explained to the patient that his symptoms are far in excess of the causative organic disease.

The organic factor should be treated as though the psychoneurotic factor did not exist. If the patient has sufficient refractive error, muscle imbalance, or other organic ocular conditions to justify optical, medical, or surgical treatment, these should obviously be given. Likewise, any aggravating organic extraocular condition that is remediable, should receive treatment under the direction of a general

physician or specialist. The large majority of ophthalmic office patients who have a psychoneurotic factor do not need, nor can they often afford, the services of an expert psychiatrist or other specialist unless these are absolutely necessary.

Obviously no treatment can permanently cure the psychoneuroses. The increased sensitiveness and suggestibility of the psychoneurotic makes him an ideal prospect for religious, dietetic, mechanical, and other health fads and rackets, especially those involving the eyes. The exploitation of the psychoneurotic has always been a fertile field for quacks and charlatans. The formula is simple: First uselessly frighten the victim and then relieve his fears. Both are usually accomplished by overdramatization of unimportant details, and concealment of the important facts, thus confusing the patient's real problem.

In the early stages of organic diseases of the nervous system or other parts of the body a functional phase may be encountered. From the history it is usually not difficult to separate this group of patients, who should be more thoroughly studied before permanent treatment is instituted. During this transition period hygienic treatment intelligently given can do no harm.

The psychoneurotic factor can best be relieved by health routines. They alone can help the patient integrate into his daily life all the essentials of physical and mental hygiene, which are:

1. Sleep enough to recharge your vitality; not to sluggishness.
2. Eat amply for bodily sustenance; not to gluttony.
3. Work industriously for maximum accomplishment; not to weakness.
4. Exercise daily for greater strength of body and mind; not to prostration.

5. Take recreation wisely for renewed vitality; not to dissipation.
6. Protect your body reasonably against climatic excesses; not to coddling.
7. Eliminate your body poisons before they poison you.
8. Clean and keep clean your body. Nature's best insurance against sickness is reasonable cleanliness.
9. Observe and daily cultivate a normal outlook on life; otherwise you will be unhappy and unhealthy.
10. Use stimulants very moderately. They borrow from your tomorrows. Don't bankrupt your future health.

The following basic routine incorporates these 10 fundamentals of health into the 24 hours that constitute the day.

1. Immediately upon rising, take three to four glasses of water—glaucoma patients excepted—warm in winter, ordinary in summer.
2. Then 5 to 10 minutes' body-building exercises in one-two rhythm. On "one" breathe in; abdomen goes out. On "two" breathe out; abdomen goes in. Try these five exercises: (1) Sailor fashion swimming. (2) Push ups. (3) Toe touches. (4) Crossed toe touches. (5) Spread eagle. Begin with 5 of each, increasing one daily to from 15 to 25 each.
3. Take a bath as cool as you can comfortably stand.
4. Follow with a three-minute body rub.
5. Then a three-course breakfast; fruit, cereal, meat or egg course.
6. Now for the chores of the morning.
7. Noon—light meal: fruits, vegetables, salads only. Avoid heavy meats, fried foods, and so forth. No meal to be eaten in less than 20 minutes. If possible, rest 30 minutes before returning to work.
8. The chores of the afternoon.

9. For the evening meal eat what agrees with you in quantity and quality. If tired or upset, rest for 30 minutes before eating, preferably by lying down.
10. Remember: (1) No smoking before your noon meal, and never more than 10 cigarettes in any day, preferably 5. (2) Never more than two drinks containing caffeine (coffee, tea, cola drinks). Even if alcohol agrees with you, never more than two drinks in any one day.
11. Eight hours of sleep.
12. At least 10 hours' outdoor recreation weekly in not less than three installments is essential for the best prolonged good health. This diversion should be in the fresh air, under your own power, not too exhausting to your body or mind. Nothing else matters. One person finds it in golf, another in gardening, another in hiking, and so forth. Wishful thinking indoors is no sane substitute for outdoor recreation.
13. Your working week should vary between 40 and 55 hours, depending upon you and upon your work.

Those who have organic diseases should be advised by their physicians concerning desirable modifications of this routine and the benefits to be derived from medical and surgical treatment.

The health routine here outlined is founded on sound physiologic principles. The three to four glasses of water taken immediately on rising, if followed by body-building exercises, especially of the abdominal muscles, in most persons promptly start the gastro-intestinal reflex. This results in a bowel movement usually within 10 or 15 minutes if diet has been reasonably correct quantitatively and qualitatively, and no organic disease exists that will prevent. Morning body-

building exercises combined with deep-breathing exercises keep body muscles firm and supple and increase the appetite for breakfast. The three-course breakfast is urged because it is the energy meal of the day. The noon meal should be light especially in warmer climates. A heavy mid-day meal makes one feel heavy, therefore necessitating more effort and causing more fatigue for afternoon work. Fast eating and eating when tired or upset are responsible for many digestive disturbances. The reduction of stimulants to two grains of caffeine daily, one ounce or less of alcohol daily, and five cigarettes or the equivalent of tobacco daily with no smoking before noon should need no further explanation to the unprejudiced physician.

Although sympathetic understanding is essential, the psychoneurotic patient must be clearly made to understand that maximum relief can be obtained only by strict adherence for at least one month to an intelligent health program. He must decide whether or not he wants to get well sufficiently to do what is necessary. If he does not have the fortitude nor the urge to do his necessary part in regaining health, then he obviously has no right to expect to get well as quickly or as completely as possible. In practice, this seldom happens. The patient thus becomes a partner with the ophthalmologist in the solution of his eye-health problems. Both must do their part. During the past 25 years in which I have experimented successfully with health routines on myself and on thousands of patients, I have become more and more convinced that they fill a needed place in ophthalmic practice for which there is no substitute.

The following diagram based on the 168-hour week integrates approximately the minimum and maximum time ordinarily required.

## ILLUSTRATIVE CASES

## Health Routines as Auxiliary Treatment

Symptomatic improvement, ocular  
and extraocular

*Case 1.* T. E., a boy, aged 12 years, was overweight, hypersensitive to pain, allergic to several foods and other substances

the right eye. There was no extraocular organic disease. Refraction under cycloplegia was R.E. and L.E.  $-1.50D.$  sph.  $\approx -0.25D.$  cyl. ax.  $180^\circ$ , vision 20/20. The diagnosis was (1) compound myopic astigmatism, (2) angioneurotic edema, (3) styes, recurrent, (4) psychoneurotic element (50 percent).



Fig. 1 (Bahn). Practical division of time in a 168-hour week.

that produce asthmatic attacks. In an exaggerated manner he complained of blurred sight and severe pain, especially in the right eye following close use; lid swelling, periodically; and styes. Examination revealed transparent ocular media; muscles, fundi, and adnexa normal, except transient lid swelling, especially of

Remarks: The psychoneurotic element was computed from the history, the objective findings, and the behavior of the patient: (1) allergies; (2) asthma; (3) does not get along with other children; (4) angioneurotic lid edema; (5) objective findings are far less than his subjective complaints.

**Treatment:** In addition to a slight change of glasses and local treatment, the patient was placed on the basic routine mentioned. Within several weeks his ocular symptoms were greatly improved. His symptoms have repeatedly become worse after discontinuance of his health routine. This patient has been under observation since early childhood.

*Case 2.* W. L., aged 18 years, was a mentally alert, energetic, and ambitious student. He suffered from headaches and blurred sight following prolonged close use, during eight years; at times his lids twitch and itch. There was no extraocular disease but the patient used caffeine excessively, and did not obtain sufficient outdoor recreation and sleep.

Examination revealed transparent ocular media; the muscles, fundi, and adnexa were normal, with the exception of the lids, which were slightly red and thickened. Refraction under cycloplegia was R.E.  $-4.00D.$  sph.  $\approx -2.00D.$  cyl. ax.  $180^\circ$ , vision 20/20; L.E.  $-4.00D.$  sph.  $\approx -1.50D.$  cyl. ax.  $180^\circ$ , vision 20/20. The diagnosis was (1) compound myopic astigmatism, (2) seborrheic blepharoconjunctivitis, (3) psychoneurotic element (25 percent).

**Treatment:** In addition to receiving a slight change in his glasses and local treatment for the seborrhea the patient was placed on the basic routine. His headaches ceased as did his blurred vision and his excessive ocular fatigue. Upon discontinuance of his health schedule, however, his ocular symptoms recurred. Quoting from one of his letters: "Your routine has proved very beneficial. I am following your instructions to the letter. It solves the problem of getting exercise for the most part. So far I am feeling very good physically, and in a large part I attribute it to the routine you suggested. Also, I have followed your advice con-

cerning my diet. I find it very helpful and I feel more alert and peppy." This patient has been under observation for eight years.

*Case 3.* M. Q., 19 years of age, was a stenographer. She was small, stocky, dynamic, and restless. She complained of floating spots before her eyes followed by headaches, present for 11 years. There was no extraocular organic disease, but she did not receive sufficient sleep, outdoor recreation, and exercise. The ocular media were transparent; the muscles, fundi, and adnexa were normal. Refraction under cycloplegia was R.E. and L.E.  $+0.5D.$  cyl. ax.  $90^\circ$ , vision 20/20. The diagnosis was (1) hyperopic astigmatism, (2) ophthalmic migraine, (3) psychoneurotic element (75 percent).

**Remarks:** Psychoneurotic element computed from history, findings, and results of treatment: (1) functional autonomic disturbances, muscae volitantes; (2) lack of objective findings, ocular and extraocular; and (3) improvement by a regulation of daily living habits.

**Treatment:** Following the correction of her refractive error and the adoption of the basic routine, the floating spots disappeared and the migraine attacks became less severe and frequent. During five months of observation, the patient's attacks became worse only when her health schedule was neglected.

*Case 4.* T. G., 35 years of age, was a slender, sensitive stenographer, seeking relief from headaches which were worse after close use of the eyes. She complained of floating spots and blurred vision. There was no general organic disorder except slight menstrual irregularities, and periods of melancholy of unknown causation. The media, muscles, fundi, and adnexa were normal except for the lids, which were slightly thick-

ened and red. Refraction under cycloplegia was R.E.  $-2.50D.$  sph.  $\approx -0.25D.$  cyl. ax.  $180^\circ$ , vision 20/20; L.E.  $-2.25D.$  sph.  $\approx -0.50D.$  cyl. ax.  $180^\circ$ , vision 20/20. The diagnosis was (1) compound myopic astigmatism, (2) slight seborrheic conjunctivitis, (3) psychoneurotic element (75 percent).

Remarks: The psychoneurotic element was computed from the history and the result of treatment: (1) periods of melancholy, (2) improvement by health routine. This patient had been seen by numerous ophthalmologists. One had given her prisms, another had given her bifocals; both without success.

Treatment: A slight change in her glasses, and local treatment for the slight blepharoconjunctivitis were ordered. The basic routine was advised, reducing her working hours to not more than 45 hours weekly. She was also advised to take 10 to 12 hours of outdoor recreation a week, to eat a heavy breakfast, a light lunch, and to get a minimum of eight hours of sleep nightly. During the three years which she had been under observation, her glasses had been changed twice, but no prisms nor bifocals were given. She is free from symptoms as long as she follows her routine, and feels much better physically and mentally.

*Case 5.* D. C., 20 years of age, was a medical student, slender, sympathetico-tonic, and fairly well nourished. He complained of blurred vision and ocular fatigue following close use. During childhood his eyes had been crossed for a short time. There were no extraocular diseases, but he was physically soft, had faulty eating habits, and did not get sufficient outdoor recreation and exercise. The ocular media, muscles, fundi, and adnexa were normal. Refraction under cycloplegia was R.E.  $+4.00D.$  sph.  $\approx +1.00D.$

cyl. ax.  $90^\circ$ , vision 20/20; L.E.  $+3.75D.$  sph.  $\approx +0.50D.$  cyl. ax.  $90^\circ$ , vision 20/20. The diagnosis was (1) compound hyperopic astigmatism, (2) psychoneurotic element (50 percent).

Remarks: The psychoneurotic element was computed from the history, behavior, and the results of treatment: (1) increased excitability and fatigability, ocular and extraocular; (2) improvement of daily living habits through health routines.

Treatment: His treatment consisted in a slight change of glasses, and adoption of the basic routine. During the 10 months that he had followed the health schedule prescribed, his condition had markedly improved. He now has no discomfort after prolonged close work. He attributed this improvement largely to his health routines. He had been under observation for more than a year.

*Case 6.* B. U., a business man aged 57 years, was tall, ruddy, and active. He suffered from dizziness and severe headaches which interfered with his work. No general disease existed, but he worked excessive hours, had faulty eating habits, and used tobacco excessively.

The media, muscles, fundi, and adnexa were normal. Refraction was R.E.  $+5.00D.$  sph.  $\approx +2.00D.$  cyl. ax.  $15^\circ$ , vision 20/50; L.E.  $+8.00D.$  sph.  $\approx +2.50D.$  cyl. ax.  $135^\circ$ , vision 20/50. The diagnosis was (1) compound hyperopic astigmatism, (2) psychoneurotic element (50 percent).

Treatment: A slight necessary change in his glasses and a change in his living habits by health routines (heavy breakfast, 40 hours of work per week, not over 10 cigarettes daily, and 10 hours' outdoor recreation weekly) markedly improved his condition.

After several weeks he reported that he felt much better and was working every

day as though nothing had ever been wrong with him. He gained four pounds within a few weeks, and was free from headaches and other symptoms. The patient has been under observation for seven years.

*Case 7.* E. N. was a business man aged 50 years, tall, ruddy, and dynamic. He complained of periodic headaches, ocular pain, and redness and tired feeling following close use of the eyes. There was no extraocular disease, except slight chronic rhinitis and sinusitis. He did not get sufficient outdoor recreation nor sleep.

The media, muscles, fundi, and adnexa were normal except for swollen lids and a small chalazion. Refraction was R.E. +2.50D. sph.  $\ominus$  +0.50D. cyl. ax. 90°, vision 20/30; L.E. +1.00D. sph., vision 20/100. The diagnosis was (1) hyperopia, (2) hyperopic astigmatism, (3) congenital amblyopia, left eye, (4) psychoneurotic element (50 percent).

Correct glasses and local treatment of the blepharoconjunctivitis do not give this patient the ocular comfort that he enjoys when he follows a definite health routine. Upon its discontinuance, as has occurred repeatedly during the past 10 years, his ocular symptoms reappear. The patient had been under observation for more than 14 years.

*Case 8.* O. T., a teacher, aged 67 years, was tall, slender, active, and meticulous. She complained that at intervals since 1926, her eyes became tired easily, especially after she had been reading, and she was afraid of developing glaucoma, a condition present in an aunt. There were no extraocular organic diseases, but the patient did not sleep well, was anxious and irritable.

The media, muscles, and adnexa were normal. Fundus examination, each eye,

revealed disc excavation that was large and flat without overhang. The visual fields and blind spots were normal. The tension varied between 28 and 32 mm. Hg (Schiötz). Refraction was R.E. +1.50D. sph.; L.E. +1.50D. sph. The diagnosis was (1) hyperopia, right and left, (2) glaucoma simplex, (3) psychoneurotic element (75 percent).

Remarks: The psychoneurotic element as computed from history and behavior: (1) anxiety neurosis; (2) behavior—restless, talkative, self-conscious.

Treatment: With 1-percent pilocarpine solution the tension remained 25 mm. Hg (Schiötz) in both eyes. Health routines were advised, and the patient stated that her ocular symptoms as well as her general well-being depended upon following her health schedule. She felt the need for this general treatment since her eye symptoms get worse when health routines are omitted. Her fear of blindness, apparently the psychoneurotic factor which aggravated the glaucomatous condition, vanished. She had been under observation for more than 16 years. Obviously, the routine treatment and periodic reexamination of the patient include an important psychotherapeutic factor, which must be considered in the treatment of this type of patient.

#### SUMMARY

1. The rate of psychoneuroses in ophthalmic practice is 75 percent compared with 50 percent in general practice.
2. Psychoneuroses involving the eyes are essentially due to imbalance of the autonomic nervous system.
3. Symptomatic manifestations are: visual, sensory, secretory, vasomotor, and motor disturbances.
4. The functional element of the patient's symptoms is usually easily separated from the organic elements.

5. Health routines are the only practical treatment of the functional element.

6. Health routines integrate all of the fundamentals of physical and mental hygiene in the correct timing, the proper order, and the most intelligent manner.

7. A basic health routine is given in detail and its adaptation explained and illustrated by case reports.

I appreciate the assistance of Dr. E. Schmerl in the preparation of this paper.  
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### STUDIES ON THE INFECTIVITY OF TRACHOMA\*

#### XIII. FURTHER EXPERIMENTS ON THE ANTIGENICITY OF THE VIRUS

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Observations made in this laboratory during the past have revealed an ineffectual, if not inexistent, immunity in monkeys following spontaneous recovery from experimentally induced trachoma.<sup>1</sup> Attempts, moreover, to demonstrate formation of specific antibodies in the sera of patients and infected monkeys, as well as of artificially "immunized" animals, were completely unsuccessful even with as delicate a technique as the virus-neutralization or protection test.<sup>2</sup> The recent revival by other workers<sup>3</sup> of an earlier method employed for the detection of minute quantities of either antigen or antibody,<sup>4</sup> since the immunologic studies on trachoma by the writer, suggested a re-investigation of the problem. Originated by Jones<sup>4</sup> when he demonstrated that the more usual precipitation reaction of egg albumin and homologous antiserum could be manifested instead as an agglutination reaction by physically attaching the antigen (that is, egg albumin) to collodion

particles, the procedure has undergone several modifications from adsorption of antibody as well as antigen to various agents including even bacteria. In the light of these observations, therefore, it became of interest to redetermine in accordance with the newer principle the presence of antibodies accompanying trachomatous infection and artificial immunization.

#### METHODS OF STUDY

*Antibody (sera).* The sera studied for antibodies were derived from both Navajo and white patients suffering from trachoma for a period of time varying from a few months to several years. Additional sera were obtained from infected monkeys in different stages of the experimental disease and following recent recovery. That the variety of sera studied might be inclusive, both monkeys and rabbits were "immunized" by intravenous injections of grattage material obtained each time from active patients. The injections were repeated every three or four days over a period of almost three months. Both types of antisera were

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found to be inactive in the neutralization test as previously reported.<sup>2</sup>

*Antigen (trachomatous virus).* Antigen was employed in the form of grattage material of proved infectivity for monkeys. The conjunctival scrapings were collected immediately preceding each test and they were ground aseptically with mortar and pestle without the use of an abrasive. The macerated tissues were suspended in broth on a basis of 2.0 c.c. for each patient. That sufficient material might be available for each experiment, tissues from several patients were pooled. Adsorption of the virus contained in the conjunctival scrapings was attempted only with *Serratia marcescens* (B. prodigiosus), as first suggested by Jones and Roberts.<sup>3</sup> Young cultures (16 to 18 hours) grown on agar slants were emulsified in a few cubic centimeters of sterile saline so as to obtain a heavy creamlike suspension. After two or three washings, the organism was killed by heating at 56° to 60°C. for one-half hour. Then, equal volumes of bacterial suspension and ground grattage material were mixed thoroughly and incubated at 37°C. for periods varying in different experiments from two hours to eight hours with occasional agitation of the mixtures during the incubation. Upon removal from the incubator, the material was centrifugated and washed two or three times and finally it was suspended in broth in different concentrations up to the original volume of culture. Inoculations in monkeys were conducted both by swabbing the conjunctiva and by subconjunctival injection. In other experiments, ground conjunctival scrapings were inoculated from a young broth culture (16 to 18 hours) of the organism. Incubation could not be carried out for long periods because of the danger of inactivating the virus kept beyond this interval under such conditions. However, incubation was allowed to proceed for

four and six hours, at the end of which time washing was performed as above. This mixture was also inoculated in monkeys.

*Agglutination reactions.* Agglutinations were done with the different sera described above. The dilutions ran serially from 1:1 and 1:5 to 1:640. Incubation was carried out in the water bath for two hours (37°C.) and after that the tests were placed in the refrigerator until the following morning when final readings were made. In addition, several tests were undertaken in the form of microscopic agglutination. The dilutions of serum studied in such instances were 1:1 and 1:5, and observations were made up to one hour only.

*Fixation of antigen-antibody complex.* In three additional experiments, advantage was taken of the recently described modification introduced by Goodner<sup>4</sup> for the detection of viral antibodies. In this instance, reliance for the reaction is placed not so much upon the fixation of antigen or antibody individually, but rather upon the adherence of the combined antigen-antibody to the collodion particles, so that interaction between the two substances undergoes flocculation more readily, and, therefore, it becomes grossly visible. Accordingly, a collodion suspension was prepared by the Cannon-Marshall<sup>5</sup> method and it was subsequently added to the virus-antiviral system. Thus, then, ground grattage material was centrifugated at 700' r.p.m. for five minutes to eliminate the larger tissue fragments. The supernatant fluid was then diluted in 0.5-c.c. quantities serially from 1:1 to 1:32, and to each dilution was added 0.2 c.c. of serum, 0.2 c.c. of saline, and 0.1 c.c. of collodion suspension. The tests were placed in the water bath at 37°C. for one hour and then, after refrigeration overnight, final readings were made.

In parallel with the foregoing experi-

ments, tests were conducted to place in demonstration a precipitation reaction between virus and serum. Thus, it is known, both from this laboratory and elsewhere, that the virus of trachoma is soluble in bile. Consequently, the centrifugated sediment from the aforescribed tests was taken up in undiluted ox bile, in volume approximately equal to one third the original; the remainder was made up by the addition of nutrient broth; and dissolution was aided by one-half hour in the water bath at 37°C. At the end of this time, practically all the material had gone into a viscous solution, and what tissue remained was separated by centrifugation (700 r.p.m. for five minutes). The dissolved material was distributed in tubes in dilutions of 1:1, 1:5, 1:50, 1:100, and 1:250, and these were supplemented as described in the experiments with the undissolved portion. The technique from then on was similar to that in the preceding tests.

#### OBSERVATIONS AND COMMENT

In order to determine whether trachomatous virus was able to withstand the treatment imposed upon it, and whether adsorption on the bacterial cell had actually taken place, both the washed organisms and the first sedimented material (containing most of the original tissue cells) were inoculated in monkeys as described. It is interesting that not a single monkey, so inoculated, showed any subsequent sign of experimental trachoma. This implies, therefore, that the virus became ineffective during the manipulation. Whether, however, the apparent inactivation is to be considered as genuine in the sense that the virus was destroyed or whether inactivation was only simulated due to dilution beyond its range of infective capacity is not readily determined from the data. Past experience<sup>5</sup> concerning the nature of the virus, however, renders the

former alternative, at least, more probable. It may be of interest to add that the subconjunctival injections of the suspensions containing live bacteria were tolerated without appreciable reaction.

Gram stains as well as Wright stains of the original organism following incubation with conjunctival scrapings were in every way similar to those made of the original cultures. In other words, if adsorption of the virus on the bacterial bodies had taken place, there was no evidence of the phenomenon either by microscopic appearance or by animal inoculation.

The agglutination tests were conducted both microscopically and grossly. In both cases, not a sign of reaction occurred, despite the variations incorporated in the latter technique. This implies one of three possibilities, singly or in combination: (1) insufficient or unsuccessful adsorption of the virus on the bacterial cell; (2) alteration in serologic specificity of the virus; (3) deficiency of antibodies in the sera tested.

Inability to infect monkeys with the bacterial suspensions prepared as described above is the most feasible means of determining adsorption of the virus on the organisms. Since, however, other reasons may explain the noninfectivity of the treated organisms as already referred to, it becomes difficult to state how much adsorption, if any, had been accomplished. Success with other viruses suggests, however, that adsorption may occur and that lack of infectivity may be the result of some other factor, possibly dilution or inactivation. That alteration in serologic specificity of the reactive antigen is difficult to accept as a plausible explanation is obvious from (1) the treatment was not sufficiently severe to cause drastic antigenic denaturation of their serologic integrity. The final possibility suggested, that the sera are free of anti-

body, appears to be the most plausible of the explanations offered above. It must be remembered that while adsorption of antigen on particulate material increases the sensitivity of certain antigen-antibody reactions, it does not yield reactions in the absence of the one or the other component. This technique has been particularly serviceable because it accentuates a phenomenon occurring less effectually by other means rather than to place in evidence a reaction previously undetectable. Consequently, since virus was originally present in the material employed, it is reasonable to suppose that just as previous studies revealed an absence of antibody formation in trachoma, so this study, also, leads to a similar conclusion.

In support of this conclusion may be cited the experiments described above in which fixation of the antigen-antibody complex on collodion particles was attempted. Employing the technique of both agglutination and precipitation to further combination of virus and antibody, the tests failed to yield at least visible floccu-

lation. Since inclusion bodies were found in the tissues employed, it logically follows that virus was similarly present. It stands to reason, therefore, that the absence of demonstrable reaction in the systems employed is attributable to a fault in the antibody either qualitative or quantitative in nature.

#### SUMMARY

The present report records the attempts made to adsorb trachomatous virus on bacterial cells in order to render it agglutinable by "antisera" obtained from patients, experimentally infected monkeys, and artificially immunized monkeys and rabbits. Other attempts to demonstrate serologic reactivity by fixation of combined antigen-antibody on collodion particles were likewise unsuccessful. The observations suggest that such sera are devoid of antiviral antibodies, thus confirming the results of a previous study.

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## MODIFIED EWING OPERATION FOR CICATRICIAL ENTROPION\*

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### HISTORICAL

In reviewing the operative steps of many of our modern surgical procedures, it will often be found interesting to survey the historical aspects of the subject. The operation for entropion presents no exception, having a proud heritage of its own dating back to the early centuries of the Christian era. However, it is not the aim here to give a comprehensive survey of all the various types of entropion operations that have been devised, in the past or present, but merely to review briefly those in particular which have preceded, in successive stages of development, the present-day modified Ewing procedure as performed routinely at the Missouri Trachoma Hospital.

The earliest prototype was an incision made under the lid, into the conjunctiva and tarsus, throughout the whole length of the lid margin; this simple procedure was given due importance in the writings of Celsus,<sup>†1</sup> Aetius,<sup>‡2</sup> and Paulus Aegineta<sup>§3</sup> in their descriptions of lid operations. This incision, termed *subsectio palpebrae*<sup>1</sup> (Celsus) or *hypotomy*<sup>‡</sup> (Aetius), was generally known and practiced during the times of the early Christian era. It later fell into neglect, and was not revived until Crampton,<sup>2</sup> in the early nineteenth century, made such an incision

a part of his own more complicated operation.

About 1833, von Ammon<sup>3</sup> gave the name tarsotomy (*tarsatomia horizontalis*) to a more radical procedure in which the incision was not limited to the conjunctiva and tarsus, but penetrated the entire thickness of the lid. Thus a marginal strip of cilia-bearing tissue was left as a detached bridge which was united to the eyelids at both ends.

Green,<sup>4</sup> in an early paper (1876), called attention to the "under-incision" as originally practiced by the ancients, giving it the term *subsection*, and deeming it superior to the modification of von Ammon. He believed Von Ammon's tarsotomy to be defective in that the integrity of the vascular connections was broken, thus inviting the danger of sloughing. Green's purpose in limiting the incision to the conjunctiva and tarsus, therefore, was to conserve the natural vascularity furnished by the skin and orbicularis. In his translations<sup>5</sup> from the Latin and Greek, he gave due credit to the classical writers for the prominent part which they assigned to subsection. Green's description<sup>6</sup> of their procedure follows: "It (the under-incision) consists in an incision through the tarsal conjunctiva, parallel to the lid-margin, and extending into or

\* From the Missouri Trachoma Hospital, Rolla, Missouri (Division of the Missouri State Board of Health).

† 1. CELSUS, celebrated Roman physician, about the first half of the first century A.D., in his "De Artibus," gave lucid accounts of surgery of the eyelids.

2. AETIUS, Greek physician and writer of the sixth century A.D.

3. PAULUS AEGINETA, celebrated medical writer (Greek), of the latter half of the seventh century A.D.

Above biographies from Harper's Dictionary of classical literature and antiquities, edited by H. T. Peck, publ. 1896 by Amer. Book Co., New York.

‡ At the suggestion of Dr. John Green, the authors have taken the liberty of coining this term as a free translation from the original Greek term: *υποτομή*, from *υπο* = under, and *τομή* = a cutting.

through the tarsal tissue; it is described as being in some cases sufficient in itself to cure the incurvation of the lid, but as requiring in other cases to be supplemented by the excision of a strip of skin from the front of the eyelid. In certain cases it was recommended to make two parallel cuts instead of a single under-incision." Green not only emphasized the simplicity of this classical operation, but stated further that, in comparison with other more radical and complicated procedures, subsection had the advantage of not encroaching farther upon tissues already shrunk from previous cicatrization; and that, when properly executed, it healed smoothly and without tending toward a reproduction of the original incurvation; and, finally, that the incision could be instituted at an early stage of the disease, and be repeated *ad libitum* without causing gross deleterious effects upon the architecture of the lid.

Green's operation<sup>6</sup> combined the use of subsection with the removal of a small strip of skin, 2 mm. wide, from the anterior surface of the lid; three single-armed sutures were then introduced at the cilia border, passing through the skin wound and then deep into the muscularis, upward and backward, to graze the anterior surface of the tarsus, and made to emerge about 1 cm. behind the point of entrance. When tied snugly, these sutures not only closed the skin wound, but strongly everted the lid border.

At the turn of the century (1900), Ewing<sup>7</sup> developed use of subsection, with the introduction of sutures, for operation on the lower lid. He approved highly of Green's subsection *per se*, but he claimed that it alone was not quite satisfactory when operating upon the lower lid because of the difficulty in keeping the tarsal incision widely open during the process of healing; he endeavored to fill in the gap in the tarsus by means of conjunc-

tiva. Ewing's method consisted in dissecting the tarsal conjunctiva away from the tarsus, from a short distance behind the openings of the meibomian glands to a width of about 5 mm., and then suturing the loosened conjunctival membrane into the bottom of the angle of the tarsal incision. In this manner, the sutures, when tied, caused a gap to be formed at the line of incision, thereby serving to evert the lid margin.

A few years later, Ewing<sup>8</sup> made several improvements, not only in simplifying the operative technique, but also in the manner of inserting the sutures. Beginning with a deep subsection down to the muscle layer, he employed three mattress sutures passed through the conjunctival edge of the wound (on the main body of the cut tarsus), then through the marginal strip, entering at the bottom of the wound between the muscle and the detached cartilage, to emerge on the dermal surface at a little beyond the line of cilia. The needle was then reentered through the skin in the same horizontal line, and about 3 mm. distant from the point of exit; the threads were tied in the conjunctival incision, leaving the loops on the *outer* dermal surface. When drawn moderately tight, the effect of the sutures was to evert the entire marginal strip. The exposed portion of the tarsus became covered with epithelium to form a conjunctival surface continuous with that of the main body of the tarsus. It should be noted here, that Ewing's sutures made their points of entrance and emergence *all on the same horizontal line*—namely, at or a little below the line of cilia—also, that they were tied on the *inner* surface of the lid. This latter step, because of the obvious corneal irritation that might result, invited the criticism of some of his fellow workers, although Ewing did call attention<sup>9</sup> to the fact that he had tried the use of double-armed su-

tures tied on the outer surface of the lid, but stated that his original method had proved more satisfactory. At a later date, however, Ewing<sup>10</sup> further developed his operation by employing the use of several (5 to 7) double-armed loop sutures, and tying them on the *outer* surface of the lid over a fairly thick strand of catgut

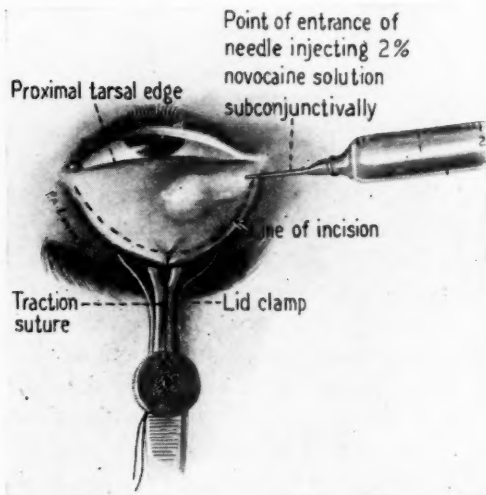


Fig. 1 (Smith and Siniscal). Right upper lid everted over a trachoma lid clamp, exposing conjunctival surface.

or braided silk. A traction suture was also introduced into the cut edge of the tarsus to assist in exposure of the wound opening.

Wiener<sup>11</sup> states that the use of double-armed mattress sutures, tied on the outer surface of the lid, was his own original modification, and was practiced by him during the time that Ewing was using single-armed sutures tied on the inside surface of the lid. This contention seems to be well borne out by some of Ewing's contemporaries,<sup>12</sup> who were associated with him in his operative work at the time.

During the course of time that Ewing's operation was employed in the Trachoma Service, it underwent additional changes,

the most important of which was the replacement of the second line of sutures (*vide infra*), tied over a strip of rubber or other semirigid body.<sup>13</sup> The result of this modification was to induce greater eversion than ever before, due to the increase in leverage effect. From time to time since then, minor changes have been added, although the operation retained its essential features; namely, an underincision through the conjunctiva and tarsus (as in the Green operation), the introduction of double-armed sutures tied on the outer surface of the lid, and limiting the operative work to the under surface of the lid without removal of tissue.

#### OPERATIVE PROCEDURE

**Preparation of patient.** Cut cilia close to the margin; wash the face and area of the operative field with tincture of green soap; flush conjunctival sac freely with metaphen 1/2,500 solution; and paint the area of the operative field with a solution of tincture of merthiolate.

**Anesthesia.** A solution of 2-percent pontocaine is instilled into the conjunctival sac several times at three-minute intervals. Then, with a 2-c.c. syringe containing a solution of 2-percent novocaine and adrenalin 1:1,000 in a proportion of 4 parts to 1 (respectively), a spot is selected at the center of the lid margin, and 2 minims of fluid are injected *subcutaneously*, raising a small bleb. This will suffice for the traction suture, which is inserted at once, as follows: A single-armed, black-silk suture is introduced through the edge of the lid, a good bite being taken with the needle, from the conjunctival surface through to the skin surface. This is tied once (to assist in hemostasis), and the free ends held taut while a trachoma lid clamp is placed with its blade behind the lid, and the latter deeply everted over the clamp, to expose the conjunctival surface,

as shown in figure 1. The free ends of the suture are entwined about the clamp set-screw with just enough tension to keep the lid on the stretch, thus providing a wide exposure of the cul-de-sac.

The subconjunctival anesthesia is given at this juncture. The remainder of the solution in the syringe is injected subconjunctivally, beginning at the temporal end of the tarsal fold (see fig. 1), and advancing the point of the needle while injecting so as to infiltrate the area sufficiently to bulge the overlying conjunctival membrane. An additional injection of about 3 to 5 minims is given subconjunctivally at the nasal end of the fold, to effect complete anesthesia in this region.

**The incision.** With a sharp Bard-Parker knife, a curved linear incision (see fig. 1) is made parallel to and along the full length of the lid margin, but placed about 2 mm. from it, firm pressure being put on the blade so as to cut *through* the tarsus. The cut edge opposite the lid margin is grasped with an Elschmig forceps (or a simple fixation forceps), and the incision completed through to the thin layer of muscle fibers lying underneath, but without injuring the latter. The tarsal body is easily identified as a hard, semirigid plate of tissue, resembling cartilaginous tissue in consistency, and ranging from  $1\frac{1}{2}$  to 3 mm. in thickness. Without removing the hold of the forceps, the tarsal plate is separated from its adherent muscle fibers by blunt dissection for a distance of about 4 mm. from its free edge, a few strokes with the blunt edge of the scalpel sufficing for this maneuver. This latter step is of importance, if a satisfactory result is to be obtained, as it allows the standing portion of the tarsus to be drawn under the edge of the detached portion when the sutures are finally tied.

**Inserting the sutures.** Alternate black

and white double-armed silk sutures are used, in a manner to be described. These not only close the wound, but also serve in the reconstruction of the lid by making traction on the detached portion of the cut tarsus, thus effecting eversion of the cilia-bearing margin (*vide infra*). As a rule, four sutures will suffice, but five

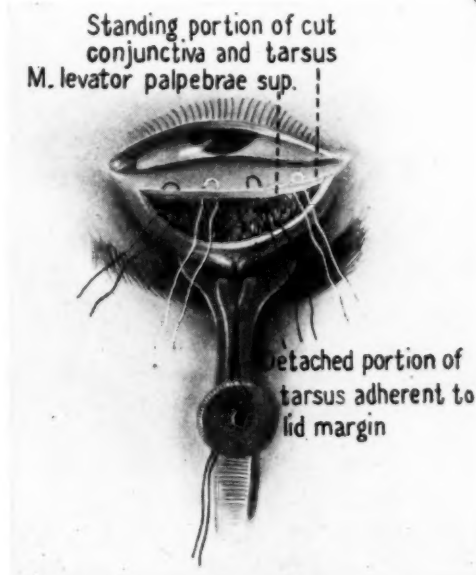
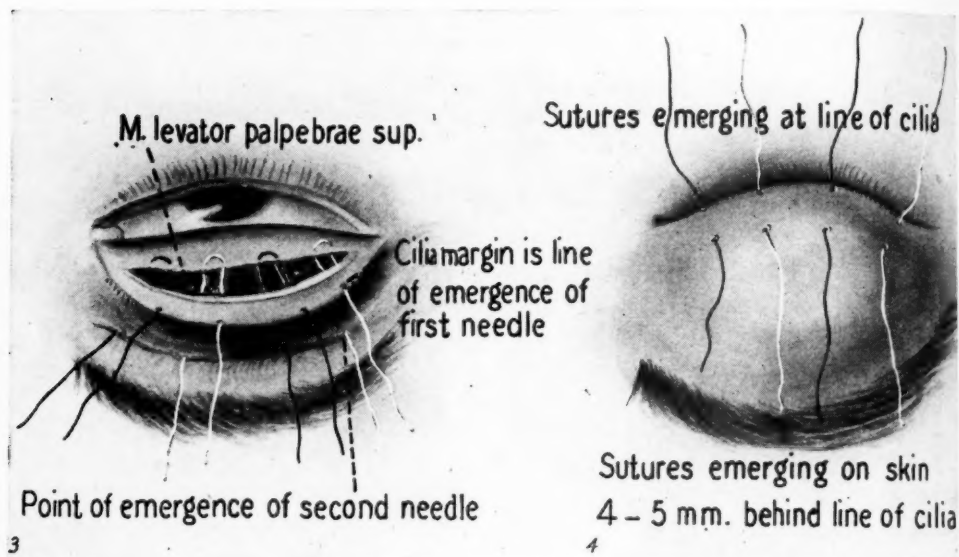


Fig. 2 (Smith and Siniscal). Showing placement of sutures (loops), using alternate black and white silk.

may be used if the length of the exposed tarsal margin warrants it. These are evenly distributed along the margin of the lid; in the former case (when using four), two are inserted on the temporal side, and two on the nasal side, of an imaginary line coincident with the vertical meridian of the cornea (see fig. 2); in the latter case (when using five), one suture is first inserted at the center, and then two placed on each side of it, spaced evenly. Each double-armed suture is *inserted* as follows: The cut margin of the standing tarsus, together with the adjoining conjunctiva, is grasped firmly with the forceps, and one needle is passed

through about 1 mm. or more from its edge, proceeding from conjunctival surface to muscle (deep) surface; then the fellow needle is similarly placed about 2 mm. distant from the first. It is important that one include the conjunctiva (or the cicatrized membrane in its stead) with the tarsus when inserting the needles. The latter are then pulled taut so that an equal length of thread is given

in the line of cilia; then the fellow needle is inserted through the depth of the incision (proceeding from inner to outer lid surface) so as to emerge at a point on the dermal surface approximately 4 to 5 mm. *behind* the line of cilia (see fig. 3, and also 6A). The remaining sutures are similarly inserted, and distributed in a manner to correspond with the placement of the loops in the standing portion of the



Figs. 3 and 4 (Smith and Siniscal). Fig. 3 illustrates the method of inserting sutures after placement of loops as in figure 2. Fig. 4 shows points of emergence of sutures with lid closed.

to each, leaving a mattress suture *in situ* (see fig. 2). When the remaining sutures have been similarly inserted and correctly placed, the lid clamp is removed by cutting off the traction suture; at this juncture the wound is thoroughly irrigated with a 1:2,500 solution of metaphen.

In the next procedure, the needles are passed *through the lid* in the following manner: First, one needle (from each loop) is inserted through the lid margin, entering the latter at the cut edge, piercing the detached tarsal strip that remains attached to the lid margin, and emerging

tarsus (see figs. 3 and 4). In more pronounced cases of entropion, in which marked eversion is desired, the second stitch is then placed from 5 to 6 mm. back. It is well to remember here that if sufficient spacing between these two points of emergence is not provided, the resultant effect (eversion) will be poor; whereas, if too much (beyond 6 mm.) is permitted, "buckling" of the skin will occur when the sutures are tied, predisposing to swelling, sloughing, and possibly to secondary infection.

When the complete number of sutures have been placed *in situ*, their ends are

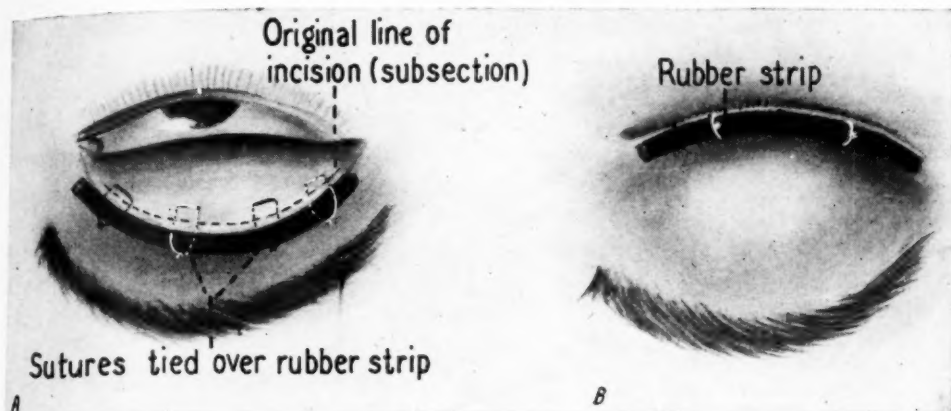


Fig. 5 (Smith and Siniscal). A, showing method of tying sutures over rubber strip; lid everted. B, same as in figure 5A; lid closed.

cut away, and the threads separated into two rows so that those emerging at the ciliary margin are laid below, toward the patient's cheek, and the others emerging several millimeters behind the first row are laid above, toward the brow (see fig. 4). Before tying, a sterile rubber strip cut from a length of inner tube, about

5 cm. in length and 4 mm. broad, is laid in place between the two rows of sutures, and the latter are then tied securely and snugly over the rubber, as illustrated in figures 5A and 5B. This step provides a means of obtaining steady leverage, thereby serving to bend the lid margin upward (producing eversion). This effect

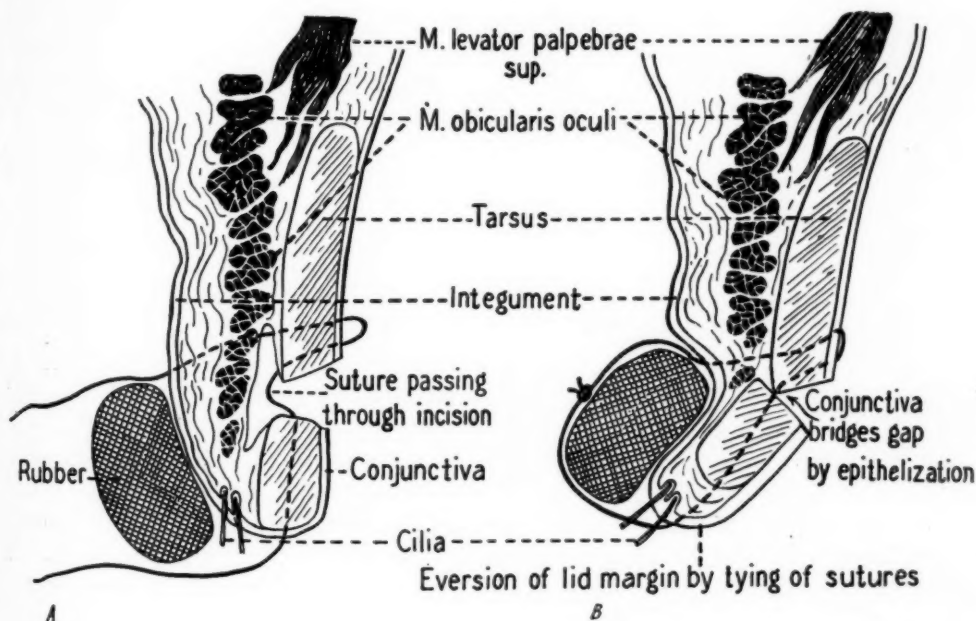


Fig. 6 (Smith and Siniscal). A, diagrammatic section through lid, before tying sutures. B, diagrammatic section through lid, after tying sutures.

should be noted as soon as the sutures have been tied, if the steps have been carried out successfully. An illustration of the lid in cross section is shown in figures 6A and 6B, demonstrating the path of the sutures, and the effect obtained when tied over the rubber strip. Care must be taken that the sutures are tied snugly, but not too tightly; also, while tying, that the skin of the lid is not buckled up over the rubber, but if the latter should occur, it must be repositioned. The superfluous ends of the rubber strip are cut off about 3 to 4 mm. from the outlying sutures, and a sterile vaseline dressing is applied for the first 24 hours. The merits of using a rubber strip, in preference to glass beads, a tiny roll of gauze, or braided silk, are many. Greater cleanliness is effected, as the rubber is nonabsorbent and does not become saturated with secretion. Further, while maintaining a desirable degree of rigidity, the rubber strip possesses sufficient elasticity to yield to pressure changes caused by the edema that frequently occurs. And, finally, we believe that the leverage effect is perhaps greater when an uninterrupted strip lies firmly across the full length of the lid, than when interrupted points of support are introduced, such as the glass beads or separate, tiny rolls of gauze.

After the first postoperative day, the dressing is kept on during the night only, being removed daily when both the wound and conjunctival sac are flushed copiously with metaphen solution. Dry heat may be applied for 10 to 15 minutes, once or twice a day, to promote healing. After the fourth postoperative day, the night dressing is dispensed with entirely, and the sutures removed on the next day. If undue swelling or a stitch abscess should develop during healing, the suture at that point should be removed. The patient may be discharged on the day or so following

removal of the sutures, provided that no secondary infection has occurred.

Surgery of both eyelids of the same eye, or the eyelids of both eyes, may be performed at the same operation. When operating upon the *lower* lid, the same steps are carried out, in the same sequence, but with the lid clamp placed below. Furthermore, because the lower tarsus is much smaller in extent than the upper, four sutures will usually suffice. Other operative limitations should be considered in keeping with the anatomy of the lower lid. It may be found that a canthoplasty greatly facilitates the operative procedure and the ultimate results in patients with an abnormally small palpebral opening and abnormally short lids. The canthoplasty should be performed at the outset of the entropion operation and left open until the latter's completion, after which it is closed in the usual manner. The illustrations were drawn from the position (that is, behind the patient's head) as seen by the surgeon during the operation.

#### CONCLUSION

At the present time, the modified Ewing operation is the method of choice of the authors in practically all cases of cicatricial entropion in patients who enter the Missouri Trachoma Hospital. During the past decade, over 500 patients have been operated upon, with recurrence of the incurvation in only 0.5 to 1.0 percent of the total number in this series, according to Hospital statistics covering this period. We find that it provides a wide range of application, and can be effectively applied to either upper or lower lid with equal facility. Moreover, a satisfactory eversion of the lid margin is produced even in cases wherein cicatrization has advanced to a marked degree and renders the carrying out of the op-

erative steps a difficult procedure. Further, the operation can be successfully performed in those few cases in which a primary operation may have failed to produce the desired amount of correction. Finally, since no incision is made into

the dermal surface of the lid, no outer scars are apparent, and the cosmetic appearance is highly satisfactory to the patient.

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- <sup>13</sup> The authors credit Dr. C. E. Rice, U.S.P.H., for this maneuver.

## AN OPERATION FOR THE CORRECTION OF PARALYTIC LATERAL-RECTUS PALSY

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Correction of paralytic strabismus by surgery is approached with respect by most ophthalmic surgeons. Certain definite indications should be present before an operation is considered. Should the indications warrant surgical interference, the type of operation selected influences the result. The surgeon may perform a simple tenotomy, or recession of the opposing muscle, combined with a resection or advancement of the affected muscle; or he may transplant tendons of other muscles.

The cases presented demonstrate two types of operations performed for lateral-rectus paralysis. In the first case, a transplantation of the lateral halves of the superior and inferior recti tendons with recession of the medial rectus was performed. In the second case, a simple resection and recession gave excellent results. The latter case was more favorable in that the paralysis existed a shorter time and was specific in type.

*Case 1.* Mr. J. V., an Italian, aged 24 years, suffered a sudden onset of double vision associated with a converging left eye in January, 1931. His family history was negative for strabismus and other ocular diseases. General physical and neurologic examinations and the Wassermann test were negative, with the exception of a paralysis of the left abducens.

Examination revealed his vision to be 20/20 in the right eye and 20/70 in the left eye, improved to 20/40+ with glasses.

The left eye deviated nasally approximately 45 degrees, as measured on the perimeter. No abduction was present. The eye could be rotated vertically but no

amount of effort carried it to the primary position laterally. External and ophthalmoscopic examinations were essentially negative. Examination under cycloplegia showed slight hypermetropia in the right eye and a small amount of myopic astigmatism in the left. An attempt to plot diplopia fields was unsuccessful. The visual fields were concentrically contracted for form in both eyes, but showed good central color perception and normal blind spots. With the arms of the orthoptoscope placed convergently at 35 degrees, second-grade fusion was attained.

Because of the discomfort and annoyance for diplopia which had persisted for six years, a transplantation of the lateral halves of the vertical recti with advancement of the lateral rectus was performed under local anesthesia at the New York Eye and Ear Infirmary, on August 13, 1937.

The operation proceeded as follows: An incision through the conjunctiva was made from the 10- to the 8-o'clock position over the insertions of the superior, lateral, and inferior recti muscles. The tendon of the superior rectus was exposed generously and held with a squint hook. A fine double-arm silk suture was inserted into the lateral half of the tendon near its insertion, which was then severed as close as possible to the globe. The lateral half of the muscle was separated with scissors for a distance of 15 or 20 millimeters posteriorly. The same procedure was followed in the case of the inferior rectus.

The lateral rectus was exposed, and fixation forceps were applied 8 millimeters posterior to its insertion. The

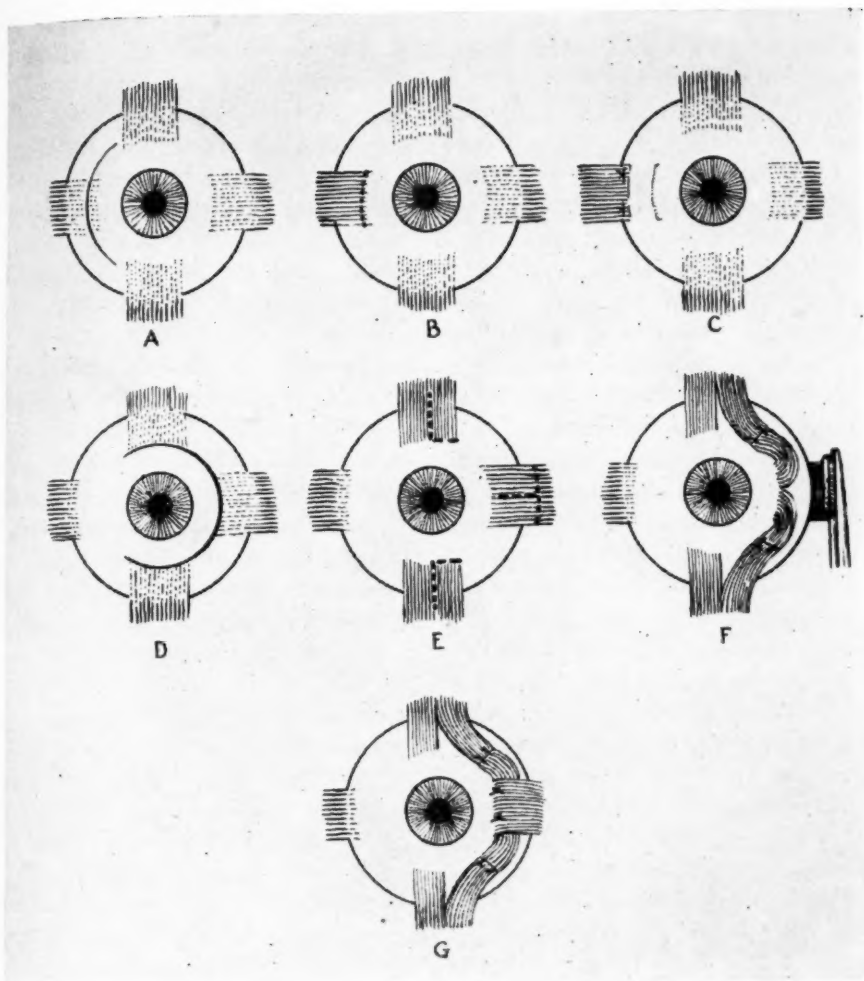


Fig. 1 (Payne). An operation for abducens paralysis. Recession of the medial rectus muscle with transplantation of the vertical recti tendons and advancement of the lateral rectus. Operation performed in two stages—a month intervening.

First stage, A, B, C. The recession operation: A, Incision through the conjunctiva, which is later closed with running suture. B, Medial rectus divided at its attachment. C, End of muscle fixed to superficial sclera with two 000 chromic sutures (care taken to pass needle through most superficial layers of sclera to avoid puncture).

Second stage, D, E, F, and G. Transplantation of vertical recti with advancement of lateral rectus: D, Incision through conjunctiva only from the 10- to the 8-o'clock position over the insertions of the superior, lateral, and inferior recti attachments, exposing the respective muscles. E, Lateral halves of the superior and inferior recti separated close to insertion. The fibers are divided 15 to 20 mm. posteriorly, with a double-armed 0000 chromic suture fixed near its end. The lateral rectus is divided as shown and the stump split to its insertion. F, The vertical and lateral muscles are united with the double-armed sutures mentioned above. G, The lateral rectus is advanced and fixed with two double-armed sutures, and the conjunctiva closed with a running suture. From Sheehan, "Manual of reparative plastic surgery," page 117. By permission of Paul B. Hoeber, Inc.

muscle was severed just anterior to the clamp. The stump was split equally up to its attachment. The divided ends of the stump were fixed to the lateral halves of the recti, respectively. The lateral rectus was brought forward over its former attachment and advanced by means of two double-armed sutures. The conjunctiva was closed with a running suture and both eyes were dressed.

Recovery was uneventful, and at the end of three weeks the patient was able to rotate the eye approximately 25 degrees laterally. A left hypertropia of 5 prism degrees and an esotropia of 7 degrees was present. A 2-millimeter recession of the medial rectus was performed about one month after the first operation.

Examination of the patient on January 8, 1938, revealed a good cosmetic result, together with an abduction of 43 degrees as measured on the perimeter and confirmed by tropometer readings. The fields of monocular fixation were almost the same for the two eyes. When tested on the orthoptoscope, the findings were: an esotropia of 4 degrees and a left hypertropia of 6 degrees without prism correction. While wearing his glasses, which contained both lateral and vertical prisms, the patient attained good third-grade fusion and was able to diverge 7 degrees and converge 26 degrees. The operations improved the patient from the cosmetic and the functional standpoint, but he still had annoying diplopia in the upper and lateral fields of gaze. Fortunately, he is able to read comfortably and experiences no difficulty when the eyes are held in the primary position.

*Case 2.* Mr. J. complained of sudden diplopia, which occurred in January, 1935. His past medical history was essentially negative. He was examined at an ophthalmic hospital, and it was found that his blood showed a strongly positive Wassermann reaction. Antiluetic treat-

ment was advised, and after two years of continuous treatment, his blood remained Wassermann fast. The diplopia persisted.

On first examination, the patient's vision was improved to normal with a +1.00D. cyl. ax. 90° in each eye. He had an esotropia of approximately 50 prism degrees for distance and near. He was unable to abduct the left eye beyond the primary position. General physical and neurologic examinations were essentially negative. The fact that the patient demonstrated some lateral rotation of the eye and occasionally brought it to the primary position accounted for the selection of a simple resection and recession operation.

The procedure, which consisted of a 4.5-mm. recession of the medial rectus and a 5-mm. resection of the lateral rectus of the left eye, was performed at the New York Eye and Ear Infirmary, on August 20, 1937. Recovery was uneventful, and diplopia disappeared after the first dressing. A series of orthoptic exercises was prescribed; and on examination, January 8, 1938, it was found that the patient had third-grade fusion with an amplitude of 5 degrees, base in, and 35 degrees, base out. No evidence of diplopia was found in any direction of the gaze. The patient had an esophoria of 2 prism degrees for near with the screen test and 8 prism degrees with the Maddox rod, but was quite comfortable.

Transplantation of the vertical recti tendons for abducens paralysis was performed as early as 1908 by Hummelshelm,<sup>1</sup> who operated on a girl 12 years of age for a congenital paralysis. An abduction of 30 degrees was obtained. Stulep,<sup>2</sup> in 1912, found that tenotomy of the medial rectus, three weeks after the transplantation, materially helped his result. Woodruff,<sup>3</sup> in 1917, pointed out the importance of a tenotomy of the medial rectus at the time of operation.

O'Connor's<sup>4</sup> operation in 1919 on an eight-year-old girl resulted in abduction of 27 degrees from transplantation alone. He advocated modified tenotomy of the medial rectus and advised shaving the transplants close to the eyeball to make the sutures more secure.

Turner<sup>5</sup> described a case in 1920, in which flaps were attached beneath the insertion of the lateral rectus. Sweet,<sup>6</sup> in 1921, attained lateral rotation of 20 degrees after transplantation alone. A subsequent tenotomy of the medial rectus increased abduction to 35 degrees. Peter,<sup>7</sup> discussing Sweet's case, advised tenotomy of the medial rectus at the time of transplant.

In 1928, Rodin and Swett<sup>8</sup> reported good results after a transplantation procedure, and tenotomy of the medial rectus.

Key<sup>9</sup> and Gifford<sup>10</sup> reported successful cases in 1929, and stressed the importance of reducing the strength of the medial rectus.

#### CONCLUSIONS

1. Operations for abducens paralysis are approached with respect by most ophthalmic surgeons.

2. The cases presented, hardly comparable in all details, suggest conservative approaches to the problem.

3. Under favorable circumstances, simple operations should precede more complicated surgical procedures.

4. If a transplantation of the vertical tendons is indicated, a recession of the antagonist should precede the transplantation.

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## TREATMENT OF HERPETIC AND DENDRITIC ULCERS

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The first observations and description of the entity which has since become known as dendritic keratitis were made 72 years ago, but the attention of ophthalmologists was first called to a certain form of keratitis by Kipp,<sup>1</sup> in the United States, in 1880, who believed it to be an accompaniment of malaria. At the same time he recorded the presence of herpetic blebs at the mouth and nostrils in several of his cases; these he regarded as coincidental.

Kipp stated that the conditions he recorded were not unlike those described by Horner as early as 1871, in that they occurred in persons suffering with herpes nasalis, following severe catarrhal affections of the respiratory passages.

Independent and simultaneous observations of an inflammatory and ulcerous keratitis were made by Hansen-Grut,<sup>2</sup> a Dane, and Emmert,<sup>3</sup> a German, in 1884, both of whom thought this form of ophthalmia had been unrecognized previously by other investigators.

In that year, Hansen-Grut, at the Eighth International Medical Congress in Copenhagen, told of this "... superficial ulceration of the cornea with a chronic course and a tendency to become serpiginous; propagation by means of buds or excrescences so that the line of demarcation of the very superficial ulcer becomes extremely irregular. The surrounding parts are clear and the cornea is not vascular. The process is in no way connected with frontal herpes and is not vesicular."

Emmert described the condition further and in more detail, especially in reference to certain grooves and branchings, and called the affection "keratitis dendritica exulcerosa mycotica."

Following these observations, case and pathologic reports appeared in some profusion in both the foreign and our own literature, as always happens.

Ellett<sup>4</sup> cited a series of keratitides, in 1899, of malarial origin, and some years later<sup>5</sup> of dendritic keratitis definitely associated with this disease. At that time the thought was quite prevalent that this form of corneal ulceration and malaria were associated. But cases were reported in patients who never had had malaria and from districts where malaria had never existed.

At about the same time Charles<sup>6</sup> concluded that dendritic keratitis was either a terminal-nerve degeneration, following certain reactions in the superficial corneal layers, caused by a toxin, or an active neuritis manifesting trophic changes where the lymph channels had been blocked.

The probability of Gasserian-ganglion involvement and an association with the sphenopalatine ganglion through the fifth nerve was stressed by him<sup>7</sup> as early as 1906.

Grüter<sup>8</sup> has demonstrated a specific herpes virus which, when transferred from the herpetic lesion in man to rabbit's cornea, induces a vesicular corneal lesion and can travel via the fifth nerve to produce an encephalitis with histologic changes, reminiscent of those found in lethargic encephalitis.

Numerous other observations and investigations have been made, and in most of these the tendency appears to be to regard the presence of an unidentified virus or toxin as the responsible agent in the production of this type of keratitis.

From the experiments of a number of

investigators, one can conclude that there is a definite relationship between simple corneal herpes and dendritic keratitis, some observers believing that the former is but the forerunner of the latter, and it has been assumed by Verhoeff that some protein or toxic shock to the ciliary or Gasserian ganglion causes superficial punctate keratitis, of which the dendritic form is an earlier stage.

There is also evidence suggesting that the herpetic viruses play a role in some forms of "epithelial keratitis" and of recurrent erosion, in dendritic keratitis, superficial striate keratitis, and keratitis deciformis as well as in herpes corneae and zoster ophthalmicus.

While general opinion seems to point to an unidentified toxin or virus as the etiological factor or causative agent in these cases of ulcer, its origin has not been definitely established; nor is it known that this lesion can be induced by the isolated action of toxins other than herpes virus; that is, pneumococcal, influenza, and malarial infection.

Very often herpetic and dendritic keratitis follow upper-respiratory infections, the pneumonias, influenza, and certain of the exanthemata.

Much has been written and proved about the way such factors may spread to the eye in connection with uveal-tract disease, retinitis, amblyopias, and so forth; and all are familiar with the ocular lesions produced by focal infections.

The blood and lymph channels have been cited often as the avenues of conveyance, and more recently some authors commenting on these, add the extension of infective viruses by way of the fifth nerve. When the trifacial is considered, beyond the Gasserian ganglion, with the numerous ramifications and the vast amount of tissues involved, it would seem that an exciting factor developing anywhere along these tracts could readily

enough extend upward and affect less resistant structures. Such a course by way of the nasal branch, through its divisions, the long and short ciliary nerves, would eventually reach the iris, ciliary muscle, and cornea.

If this eventually is proved to be true, the observations and deductions made by the earliest writers will be found not to have been far from wrong.

Accordingly, a virus or toxin with its source in a dental apical abscess, in one or more of the nasal accessory sinuses, by absorption through the nasal mucosa, might follow the aforescribed course.

For a long time thought has been given to the possibility of the association of herpetic and dendritic keratitis with malaria. The earlier literature is filled with references to this, and it seemed that quinine, given as a specific for both malaria and the ulcerations, proved its value.

Even today there is a trend again to this theory, and the use of antimalarial therapeutics as an agent in the treatment of dendritic keratitis has been revived to a degree. Perhaps this has been done because so many of the recognized standards of treatment have proved of no avail.

The range of local treatment in these ulcerations has been broad and diversified and has involved the entire category of ophthalmic remedies: atropine, anesthetics, and antiseptics; cauteries, chemical and actual; light rays of various lengths; the thermophore; the sulpha group of drugs; and finally supportive treatment with vitamins and assorted tonics, including iron, quinine, strychnine, and arsenic.

It cannot be said, however, that these were all of no benefit to the eye, but their chief effect would be analgesic and antiseptic, palliative and supportive, rather than curative with a virus as the exciting influence.

The presence in the ulcers of specific bacterial forms, especially the Pneumo-

coccus, derives from an infection imposed upon a previously broken-down cornea and apparently has nothing to do with the etiology. It is sound practice to keep the lesion free of infection by the use of local applications of antiseptics.

Very little appears in the literature and textbooks concerning the role of focal infections in herpetic and dendritic keratitis. The subject is barely mentioned and is passed over with a few lines on the possibility that such factors are influential. Nothing definite concerning this association is stated. However, Shapiro and Coles<sup>9</sup> wrote in 1940 of a case of dendritic keratitis in a girl, 10 years of age, whose infected teeth were extracted, after which there was complete recovery in six days from the ulcer.

Every one has seen erosions develop over the sites of previously healed ulcerous areas, and from these the disconcerting growth of new dendritic forms. Such a picture is an indication that something developing from within, endogenous, if that is a proper designation, be it virus, toxin, or some other agent, is present and is the cause of the trouble.

It has been my experience with ulcers of the cornea that healing took place more rapidly and thoroughly when attention was given to the possibility of focal infection and its removal.

The following cases, in each of which there was either herpetic or dendritic ulceration of the cornea and in which healing took place without recurrences after elimination of the foci, are presented.

The histories are necessarily abbreviated, only the essential facts being given. In each definite foci were found, and in all, except case 10, wherein some foci still remain, permanent healing took place.

#### CASE REPORTS

*Case 1.* Mrs. I. W., aged 47 years, was seen on January 29, 1927. She stated that

the left eye had been sore and painful for four days. A dendritic ulcer was found in the center of the cornea of the left eye.

Treatment with antiseptics was initiated and the patient was referred for nasal and dental examinations. Nasal examination showed no infection. The tonsils were normal. Five teeth were found to be abscessed. The patient was advised to have them removed; but did not do so at once. The ulcer showed no improvement.

On February 9, 1927, the teeth were extracted and the ulcer healed entirely within nine days.

*Case 2.* Mr. E. J. B., aged 35 years, came on April 15, 1927, with an inflamed and painful left eye. A large infected ulcer of the cornea, of two days' standing, was seen superiorly and concentric with the limbal border, involving about 150 degrees. Several dendrites, revealed by fluorescein, were seen to extend downward.

The patient was hospitalized, the edges of the ulcer were cauterized electrically, and the thermophore was applied. Examination of the nose and throat revealed infected tonsils, which were removed on April 19, 1927. After this, healing of the ulcer progressed and was completed in a month.

*Case 3.* Mrs. A. B., aged 69 years, presented herself in 1921, when a diagnosis of diffuse central lens changes was made.

Semiannual observations showed no change in her eyes until April 22, 1927, when I was called to her home, and she stated that the right eye had been painful and red for one day.

The right eye showed a large infected, crescentic ulceration of the cornea near the limbus, involving 120 degrees of arc, inferiorly. A few small scattered areas of denudation were found at both ends of

the arc, and because of the rapid onset and extent of the infection, I felt that this might have been a ring abscess.

The patient was placed in the hospital at once and the electro-cautery was applied, also the thermophore. All teeth had been removed years before.

A rhinologist was called, who found the tonsils to be infected. The next day the lesion had spread to involve one half the limbal circumference. Tonsillectomy was arranged.

After removal of the tonsils there was an immediate improvement, and the cornea had healed within three weeks. No further ulceration has occurred since that time.

*Case 4.* Mr. H. W., aged 30 years, was seen first in July, 1927. At that time he said his eyes had been grossly inflamed and irritated for the past year. A diagnosis of tarsitis with old trachoma was made and he was given treatment directed to this condition.

On December 16, 1927, the patient came in again, with a small herpetic ulcer of the cornea of the left eye, in the lower temporal region near the margin. It had been there for two days. Treatment was local, and on December 20th, the patient was referred to a rhinologist, who found purulent ethmo-sphenoiditis in both sides of the nose. The teeth had been removed some time before the onset of the ulcer.

Treatment of the sinusitis induced a cessation of symptoms, and the eye improved at once. The ulcer healed within one month.

*Case 5.* Mr. G. T., aged 37 years, consulted me on June 8, 1934, after a branch of a cherry tree had scraped the cornea of his right eye on the day before, and caused a central denudation.

The wound was treated with a mild antiseptic, atropine, and dressings, and

healed in three days. He left immediately on a vacation.

On September 1, 1934, he returned from this trip and stated that the eye had not been well since June 20th. Examination showed a dendritic ulcer of the cornea of the right eye in the area of the original injury, with an accompanying iridocyclitis and a few spots on the posterior corneal surface.

The eye was treated with an antiseptic, atropine, and dressings, and the patient was referred to his physician, rhinologist, and dentist. The positive findings were chronic infection in both maxillary and ethmoidal sinuses, and in the tonsils. The tonsils were removed at once and windows were made later into the antra. The nasal infection was treated.

Healing of the ulcer took place within 18 days and there has been no recurrence.

*Case 6.* Mr. C. McH., aged 47 years, sustained an injury to his left eye while chipping putty from a window frame on August 2, 1935. He consulted his physician and received treatment from him for three days. I saw him on August 5th and found a dendritic ulcer in the nasal half of the cornea of the left eye, just below the horizontal meridian. Local treatment was prescribed.

The patient was found to have a number of infected teeth on the next day, and these were extracted some time later. The eye recovered slowly, and complete healing of the ulcer took place in a month.

*Case 7.* Mr. M. C., aged 70 years, came to me on March 10, 1937, complaining of having had a sore left eye for the past four days. A limbal crescentic ulcer was found in the cornea of this eye at the nasal border, and about 60 degrees in curvature.

Local treatment was given; later the same day he entered the hospital, and

the thermophore was applied at once. At this time his remaining teeth, which were grossly infected and loose, were removed.

The eye was treated with a mild antiseptic, atropine, and dressings, and healed in 19 days.

There has been no reoccurrence of the ulcer.

*Case 8.* Miss M. G., aged 78 years was seen first on March 29, 1938, when she stated that the left eye has been troublesome and inflamed following an attack of shingles, which she had had three years previously; and that she has considerable pain in her head. Treatment by several ophthalmologists had not helped the eye. The cornea of the left eye showed a progressive crescentic ulceration, about 90 degrees of arc, 2 mm. from the margin, in the lower nasal segment. Two small round spots at the upper end and one at the lower end of the arc were noted, and these stained with fluorescein. Another small area to the left of the center showed typical dendritic branching. A diagnosis of coalescent herpetic and dendritic ulcers was made.

The eye was treated with mild antiseptics and atropine locally, and was dressed.

An April 2, 1938, the patient was referred to her dentist, who found all her 12 remaining teeth severely infected, and to a rhinologist, who found a low-grade sinus infection on the left side.

The teeth were removed in the course of a week, and the nose treated a few times. Optochin, 1 percent, was instilled, and quinine sulphate prescribed to be taken internally.

After the first four teeth had been removed, the eye began to clear immediately. The remaining teeth were extracted shortly after, and the eye healed within a month.

Nasal treatment had been neglected by

this patient, and on May 3, 1938, a small denuded point on the cornea was observed, to which the thermophore was applied. After continued treatment of the nasal infection, the eye became well in two weeks. It has remained so to date.

*Case 9.* Mrs. S. H., aged 61 years, came to me on January 24, 1942, complaining of the right eye, which had been inflamed and painful for a few weeks. It showed a crescentic ulcer, with three small coalescing areas at the superior tip, in the inferior nasal quadrant at the limbus. From the appearance of the lesion it could be seen that there had been a number of smaller denuded areas at first which had grouped themselves into the crescent.

Treatment was given with protargol, 2 percent, atropine, and dressings, and one remaining infected tooth was removed on the same day.

During the following week the ulcer showed signs of improvement but did not heal. The patient was told of the possibility of other infective foci, but put off consultation with her rhinologist until February 9, 1942, when a diagnosis of inflammation of the right side of the nose and infection in the tonsils was made. The eye made but slight progress under local treatment, and the patient was finally persuaded to have her tonsils removed. This was done on February 24, 1942.

Following this operation the eye made rapid progress toward healing, which took place within a week.

*Case 10.* Mr. C. A. B., aged 46 years, was seen on May 25, 1942, and stated that he had had influenza for the past 10 days and that the right eye had been sore and inflamed for a week. A dendritic ulcer of the cornea of this eye was found, extending vertically from top to bottom in the temporal half. The patient was treated

with antiseptics, atropine, and dressings, and referred to his rhinologist, and for X rays of his teeth.

Extensive sinusitis, infected tonsils, and four abscessed teeth, with four others in doubt, were found. The eye became comfortable under local treatment, but showed no signs of healing. The four abscessed teeth were extracted on May 29, 1942 and the ulcer began to heal. There was very little staining with fluorescein. From time to time, over a period of two weeks, additional denuded areas would show, and some days later the entire middle of the healed line broke down.

The patient was finally persuaded to have his tonsils removed, and this was done on June 26, 1942. Within five days following this operation the entire surface of the formerly ulcerated area was healed. There has been no recurrence.

Recently, however, since October 15th, two pinpoint spots have shown themselves within the original course of the lesion, and an application of the thermophore has done no good.

Mr. B. has resisted all advice regarding the removal of the four remaining doubtful teeth and treatment of his sinusitis, and there remains an exceedingly small ulcer, visible with a lens only after staining.

*Case 11.* Miss D. G., aged 21 years, was ill with tonsillitis a week previous to coming for treatment, on June 11, 1942. A herpetic ulcer was found in the inferior temporal part of the cornea of the right eye. Mild local treatment was given her for five days, and she then consulted her rhinologist, who found infection in the sinuses and tonsils, treated her for these conditions, and removed her tonsils on June 24th.

The ulcer had spread somewhat, but its progress was stopped immediately after

the tonsillectomy took place, and healing was complete in less than a week.

*Case 12.* Miss R. S., aged 20 years, was seen first on July 1, 1942, and stated that the right eye had been painful for a few days. Examination showed a small herpetic ulcer in the temporal part of the cornea, near the margin.

Treatment with antiseptics, atropine, and dressings was begun, and physical, nasal, laryngeal, and dental examinations were made.

These were negative except for the presence of infected tonsils, which were removed on July 6, 1942.

The eye improved rapidly and complete healing of the ulcer took place in three days.

#### DISCUSSION

In all these cases foci of infection were found in the sinuses, tonsils, or teeth, and there was undoubtedly a relationship between these foci and the corneal ulcers.

All resisted treatment and made no definite progress until these foci were removed. Local treatment, generally, consisted of anesthetics, antiseptics (usually optochin or protargol), and atropine; and dressings were applied in all cases.

While the thermophore was used for five of the patients, there was not so much immediate improvement as would be expected. Nor would I deprecate the worth of this instrument, which has proved its value repeatedly.

The time factor for healing was much shorter in the herpetic types than in the dendritic.

It is my conclusion that an unidentified virus which may have its origin in infections in the teeth, nose, and throat or tonsils, should be considered as an etiological factor in the production of herpetic and dendritic keratitis.

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### THE CONVERGENCE FUNCTION IN RELATION TO THE BASAL METABOLISM\*

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This is a continuation of a similar study<sup>1</sup> and includes previously reported as well as new cases. It, as well as the previous report, published in 1938, is based on a classification of near horizontal phoria and duction findings at 13 inches. This classification is supported by the data found in at least 5,000 cases.

A report on this classification has recently been made.<sup>2</sup> In brief, it stated that near horizontal phoria and duction findings could be divided into three groups: group I, the normals; group II, the subnormals; group III, the abnormals. Group I contained only those individuals who were without ocular complaints and who used their eyes sufficiently in daily activities to permit assumption of average demands upon the visual apparatus. Group II contained those whose outstanding symptom was one of tiring, both ocular and general. Group III contained the remaining cases. These cases required more detailed study. The chief symptom in this group was one of increased irritability or lowered threshold of tolerance.

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In the presentation of the data forming the basis of the classification, it was stated that the base-in readings in the normal and subnormal groups were similar, that both groups (I and II) showed the ability to relax all the convergence used to bring the eyes from parallelism to near fixation (and even a little more than this). It was also pointed out that the abnormals (group III) differed definitely in this respect, usually not having this ability. The tendency in this group to fail to give up the convergence in use at the moment suggests an overactive convergence. It was noted, also, that the base-out readings in these cases may not be considered reliable indicators of the convergence reserve, as the basic findings are masked by this overactive convergence. This view was supported by further data obtained under cycloplegia. Under cycloplegia it was frequently found that group-III cases resembled group-II cases. This was also true for group-III cases after the problems involved were fully or partially solved.

The idea of a convergence spasm superimposed on or simultaneously present with a convergence weakness should not be considered difficult to accept. Such a

state was considered by Bielschowsky<sup>3</sup> as "by no means unusual. . . ." Whether or not the picture of an underactive convergence alone (group II) or combined with an increased irritability of convergence (group III) is a reflection of the general condition is a moot question, upon which there are many views but almost no data.

Bothman<sup>4</sup> mentions convergence weakness in cases of exophthalmos following thyroidectomy. In these cases due to hyperthyroidism, movements were limited and the muscles, when exposed by surgery, showed the muscle changes described by Naffziger.<sup>5</sup> Fridenberg<sup>6</sup> mentions convergence insufficiency in the hypothyroid type but gives no data. Mayer<sup>7</sup> considers examples of convergence insufficiency as usual in exophthalmic goiter. He does not feel able to explain the convergence weakness he found in three cases of myxedema in which there was an average basal metabolic rate of -13.3 percent. He found, in cases of obesity and hypothyroidism, that ability to converge was "satisfactory" (by the approach-the-nose method). Zentmayer<sup>8</sup> considered fatigue following overstimulation of the body as a cause of convergence insufficiency. Duane<sup>9</sup> advised care of general health factors after correction of the errors of refraction and *before giving prism exercises*. Bielschowsky,<sup>10</sup> Howe,<sup>11</sup> and others have called attention to the relationship between the general health and convergence insufficiency. Davis<sup>12</sup> admits that in some cases convergence insufficiency is due to some general health factor.

Heath<sup>13</sup> says that muscular insufficiencies may be due to the general condition, such as heart trouble or nervous prostration. Fox<sup>14</sup> says, ". . . the very complexity of the condition speaks for its close relationship to the general health." Maddox<sup>15</sup> advises constitutional measures. Oppenheimer,<sup>16</sup> in 1895, mentioned the use of strychnine for conver-

gence weakness. Major Field<sup>17</sup> pointed out that too many heterophorias disappear or decrease in amount upon improvement in the general physical condition to ignore the claim that the extraocular muscles are affected by the general condition. Howard<sup>18</sup> said that in cases of hypothyroidism there may occasionally be shown a weakened convergence (by the "approach" method). Bryant,<sup>19</sup> emphasizing the importance of general health studies in the specialties, says that muscular imbalances of the eyes are not uncommon in the subthyroid individuals, the convergence being especially affected.

The author feels sure that further emphasis on the relation of the condition of the extraocular muscles to the general health should be made. It is thought that if laboratory proof of such a relationship could be presented, a definite step forward would be made both in our understanding of the extraocular muscle mechanism and in our therapy for heterophorias. In the previous study,<sup>1</sup> for the first time, the relationship between convergence and basal metabolism was reported. In table 1 are summarized the findings in 202 patients in whom the basal metabolic rates had been obtained.

In 40 control cases (group I) the basal metabolism averaged -0.75 percent. The average base-out reading at 13 inches was 20.0 prism diopters. The average base-in reading was 21.0 prism diopters. The average phoria was 5.6 prism diopters of exophoria. The basal metabolism varied from +35.00 to -19 percent, being below -10.0 in 15 percent of the cases. In 134 cases with persistent ocular complaints after correction of the error of refraction, the tests showed subnormal convergence reserve (less than 15 prism diopters, base out, for 13 inches). In this group of subnormals (group II) the basal metabolism averaged -15.2 percent. The average base-out reading was 7.6 prism

diopeters. The average base-in reading was 21.9 prism diopeters. The average phoria was 8.10 prism diopeters of exophoria. The basal metabolism varied from +21 to -25 percent, being below -10.00 percent in 112 cases, or in 83.58 percent of the cases.

In 28 cases with irregular findings typical of group III (table 1) the basal metabolism averaged -16.0 percent. In these cases the basal metabolic rates varied from +2.25 percent to -26 percent, be-

83 percent is evidenced by a subnormal basal metabolic rate. It should be emphasized that, while the author reports the finding of a lowered basal metabolic rate, with subnormal convergence reserve, he does not suggest that this finding indicates a pure hypothyroidism. In 40 percent of 20 cases in which the basal metabolic rate and the blood cholesterol were determined, the blood cholesterol was definitely above normal. In presenting this report of fairly consistent find-

TABLE 1  
SUMMARY OF FINDINGS IN 202 CASES WITH BASAL-METABOLISM

Group	Type of Cases	No. of Cases	Aver. Age	Aver. 13" Readings			Aver. B.M.R. percent	Percentage of Cases Showing B.M.R. Below	
				Phoria	Abd.	Add.		-10%	-20%
I	Controls	40	29.8	5.9	21.2	20.1	- 0.75	-15.0	0
II	Subnormal Convergence	134	30.0	8.2	21.1	7.6	-15.2	-83.6	26.1
III	Abnormal Convergence (Spasm or Excess)	28	25.0	1.0E	12.8	18.3	-16.0	-85.7	17.8

ing below -10 percent in 24 of the 28 cases, or in 85.7 percent of these cases. The average phoria was 1 prism diopter of esophoria; the average base-in reading 12.8 prism diopeters. The average base-out reading was 18.3 prism diopeters. The 162 patients (groups II and III) had an average basal metabolism of -15.3 percent. The marked similarity in the basal rates in groups II and III lends further support to the opinion that group III is composed of cases basically resembling those cases in group II.

#### SUMMARY

A definite relationship between the basal metabolic rate and the condition of the convergence function is demonstrated. Those patients with a subnormal convergence, as judged by the reserve power, have a general condition which in over

ings of lowered metabolism with subnormal convergence reserve power, it is desirable to bear in mind the possible relationship of both these findings to a possible dysfunction of one or more glands of the body or to such other factors as diet, physical and mental disturbances, or infectious processes.

An examination of the extraocular muscles should include an examination of ductions at the reading distance. The finding of a base-in reading at the break point of less than the expected amount, depending on the interpupillary distance and the working distance, should make one suspect an overactive convergence. The base-out readings at the reading distance should then be considered as possibly modified by the temporary overactivity of the convergence. A similar overactivity of the accommodation fre-

quently, although not always, will be found in these cases. Cycloplegia is, therefore, particularly desirable in these cases both for its effect on the accommodation and for the possible effect on the convergence. Under cycloplegia the previously overactive convergence may appear as a definitely subnormal convergence (as in group II).

A complete discussion of the subject of heterophorias, their nature, their diagnosis, and their treatment would require a very extensive monograph. A proper discussion of this subject would require a consideration of the phorias and the ductions at varying fixation points including the entire field of fixation. It would also require a consideration of the subjects' "primary position of rest," "divergence center," "convergence center," "accommodation and convergence relationship," "convergence excess," "divergence insufficiency," "retinal correspondence," and many other related subjects. Such a discussion is obviously beyond the scope of this article. Some of these subjects are touched upon in another article, in preparation, on the "Nature of the heterophorias."

In an individual case the cause or causes of discomfort must be determined by all the findings. However, such a high degree of correlation between the tests as used

and the general metabolic processes, suggests that one is justified in emphasizing the probability that correction of minor errors of refraction and periodic orthoptic training can be only of palliative value. Those who follow these methods to the exclusion of general care and therapy are subject to the criticism made of some nonmedical practitioners, in that they delay proper medical care. The usual effort to use the convergence function, as well as the need therefore, throughout the waking hours should be expected to be more effective exercise than the short periods of special exercises, even if given daily. That neither the normally great demands on this function, nor the especially induced demands over a short period, produce lasting results, suggests that local exercises are of little therapeutic value. Therapeutic results have been good in a considerable number of cases, but the therapy has been so varied that a discussion thereof is a subject in itself.

#### CONCLUSION

The attempt has been made to show the correlation existing between the convergence function (as studied by use of the duction method at near) and the general health (using the basal-metabolism test as a laboratory indicator thereof).

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## HEREDITARY CATARACTA CAERULEA

### SIX RELATED CASES

OTIS WOLFE, I, M.D., AND RUSSELL M. WOLFE, M.D.\*

*Marshalltown, Iowa*

This paper is being written as a report supplementary to that of three cases previously reported with a description of the technique employed.<sup>1</sup> This aspirating technique was further discussed in another publication with a description of a new aspirating needle for soft cataract.<sup>2</sup>

Briefly, these first 3 cases were observed in a mother, aged 50 years, and two children, aged 16 and 18 years. The cataracts of these three were nearly indistinguishable except that the mother also had posterior subcapsular opacities involving the central two thirds of the lens of the right eye and the central one third of the lens of the left eye. The unusual blue punctate opacification of the remainder of the cortex was identical in mother and children.

Intracapsular extractions were performed on the mother's eyes, and full normal corrected vision resulted. The two children's eyes were operated on by the authors' double-aspirating-needle technique, as described by us in a previous article.<sup>2</sup> Both children obtained normal corrected vision.

*Case 4.* The next patient, seen on January 20, 1942—nearly two years after the first patient had been examined—was a healthy and well-developed woman, 36

years of age. She had been wearing glasses since her fourteenth year, and her vision was last corrected five years prior to her examination here. The patient said that she had never enjoyed good vision, nor, on the other hand, had she ever noticed any decrease in vision, even during the last few years. Her condition so closely resembled what we had observed in our previous cases, that following the examination the patient was carefully questioned. She had nearly completely lost track of her family, but on questioning her further we were able to establish that this patient's mother and the previous patient's mother had been first cousins. A brother had cataracts and had had poor vision since birth, and we assumed that he was suffering from the same pathologic changes. However, the patient had five normal-sighted sisters.

The patient's vision in the right eye with a -4.00D. sph.  $\approx$  -3.00D. cyl. ax. 180° was only 20/200. For the left eye a -3.00D. sph.  $\approx$  -4.00 D. cyl. ax. 180° gave her only 20/200 vision also. Tension in each eye was 18 mm. Hg (Schiotz). There was no external evidence of disease of the eyes, and the adnexa appeared to be quite normal. The positions of the eyes were primary, and movements were full in all cardinal directions. The pupils were round and equal

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and reacted equally well to direct and indirect stimuli. The corneas were bright and clear, and the anterior chambers were of normal depth and clarity. The lenses revealed typical blue cataracts. Throughout the cortex there were many well-circumscribed opacities of varying shapes and sizes. Nearly all of these opacities had the same characteristic bluish or faintly purplish shade that has been described heretofore. However, there were many cortical spokes extending about a third of the way toward the center of the lens. These were not found in the lenses in the previously reported cases nor in the remaining ones. Involving the central one fifth of the posterior subcapsule, there was a semitransparent opacity of approximately the same size in each eye. However, the left eye had a punctate opacification of the anterior suture that was of a definitely bluish shade. The nuclei were essentially clear. There was no evidence of pathologic change in the vitreous nor in the fundi. However, a detailed examination was impossible to make. The patient was to return later for surgery but no word has been heard from her.

The next two cases were first seen on March 2, 1942.

*Case 5.* Mr. C. H. and Mrs. P.'s mother were brother and sister. The former has two children both with defective vision. His son was rejected for army service because of his cataractous eyes, but no designation was made as to the type. The daughter must wear glasses, but does not know what is wrong with her eyes. The patient had seven sisters, two only having good vision, the others had had poor vision from birth. The patient complained that he likewise had never had good vision but until 10 years ago was able to read large headlines in the paper. For 10 years vision had gradually diminished. His general health had otherwise been perfect. The patient was

a strong robust-looking man of 54 years, and well-developed. The general physical examination and the laboratory examination revealed nothing contributory.

Vision in the right eye was 6/200 and in the left 2/200 unimproved by correction. Tension was 14 mm. Hg (Schiotz) in each eye. There was no external evidence of disease about the eyes. The adnexa were normal. Positions of the eyes were primary, and movements were normal in all cardinal directions. The corneas were bright and clear, and the irides were normal. The anterior chambers were of normal depth and clarity. Pupils were round and equal and reacted well to direct and indirect stimuli. The lenses showed the typical blue punctate cataract described in the previous case report, but with the blue and lavender shading not so marked as in the previous cases. There were, however, beginning changes in the central portion of the posterior subcapsular position. The fundi were not seen well, but no pathologic changes were observed in the vitreous nor in the fundi.

An intracapsular cataract extraction was performed on the patient's left eye. He returned home with 20/20 corrected vision using a +11.50D. sph.  $\approx$  - .50D. cyl. ax. 90° at 12 mm. from the cornea. The patient exclaimed that he had never enjoyed such good vision before and he is to return soon for an operation on the other eye.

*Case 6.* The second patient, Mr. T. B., 47 years old, is a nephew of the first patient (case 5). He has three brothers and five sisters all having poor vision since birth, but no diagnosis had ever been made nor had they consulted doctors for their eyes. The patient has six boys and three girls all with good vision, so far as he knows. He complained that he had never enjoyed good vision but with the use of glasses had until recently, been

able to see fine newspaper print. For the last two years, however, vision had been gradually failing until he was now unable to read even fairly large headlines. Vision in the right eye was 6/200, which could be corrected to 7/200, and in the left eye 20/200, correctable to 20/70. Tension was 16 mm. Hg (Schiötz) in each eye.

Externally the eyes showed no evidence of pathologic change. The adnexa were quite normal, there was no inflammation, discharge, lacrimation, or epiphora. Positions of the eyes were primary, and the movements were full in all cardinal directions. The cornea of each eye was bright and clear and the anterior chambers were of normal depth and clarity. The irides revealed no pathologic change. The pupils were round and equal and reacted well to all direct and indirect stimuli. The lens changes were essentially the same as those described in case 5. The color of these opacities was slightly less intense than that observed in the previous cases, with the exception of case 5, which it resembled in this respect. No pathologic change was revealed in the vitreous or the fundi.

An intracapsular cataract extraction was performed on the patient's right eye. When last seen a +13.50D. sph.  $\approx$  -2.50D. cyl. ax. 90° allowed 20/20 vision.

#### DISCUSSION

Three additional cases of cataracta caerulea have been reported. As this type of congenital cataract is quite unusual we felt that it would be of interest to the medical profession to have them recorded. In addition it was interesting to find that all these cases were in the

same family. We shall try to get more specific data about the other members of the family and, if possible, come to more definite conclusions as to the involvement of their eyes and as to the numbers affected. Of special note is the fact that of the six patients, four were more than 35 years of age and had a well-advanced posterior subcapsular opacification that was not different in color from that usually observed in this portion of the lens. The opacities throughout the cortices in all six cases were essentially the same in conformation and in appearance, except for the peripheral spoke formation seen in case 4. The four adults all seem to have combated life fairly successfully until the probable onset of the posterior subcapsular lens changes. One rather wonders whether all of the cases of cataract in this family and even those unreported were predestined to have posterior subcapsular cataract. If such is the case one also wonders what characteristic of the lens cell exists to predestine these cases to opacification of the subcapsule as well as the cortex and to prearrange the opalescent lens so as to disperse light in such a way as to cause this typical blue appearance. However, Duke-Elder's explanation<sup>3</sup> is accepted as logical:

"The bright blue colour, which suggested the name *cataracta caerulea* or *blue-dot cataract* is a physical phenomenon depending on the dispersion of light. In any opalescent medium minute particles disperse the light irregularly inversely as the fourth power of the wave-length, so that the major part of the dispersed light is made up of the short blue and violet waves. The cataract is blue, therefore, for the same reason as, owing to dispersion by the atmosphere, the sky is blue."

Note: Since this report was written the lens from one eye of the patient in Case 4 has been successfully removed.

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## NOTES, CASES, INSTRUMENTS

### DEVICES TO AID REFRACTION

GLEN F. HARDING, LIEUTENANT (MC),  
A.U.S.

Ogden, Utah

Many variations of single or multiple lens devices to aid refraction procedures have been produced and described. These consist basically of spherical, cylindric,

The spherical aid consists of a group of spherical lenses in quarter-diopter graduations. The minus-power lenses are identified by gold-plated rings, the plus-power lenses by nickle plating. Lens rings are  $1\frac{1}{2}$  inches in diameter, the lens power and sign are engraved on the periphery of each.

The spherical aid used chiefly for testing hyperopic eyes has the following ar-

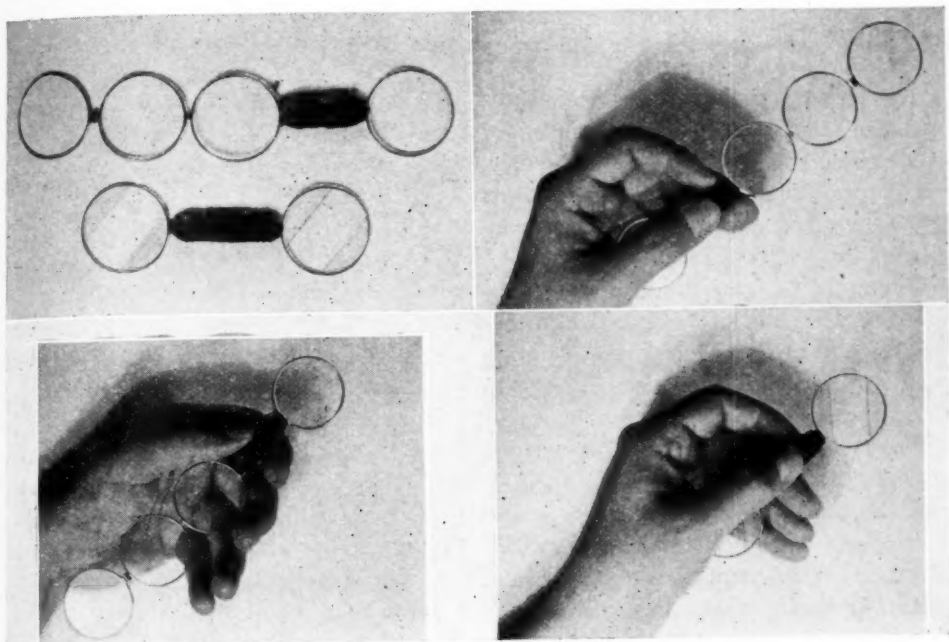


Fig. 1 (Harding). Devices to aid refraction. A, upper, spherical refraction aid; lower, cylindric refraction aid. B, Method of holding spherical refraction aid. Any one of the three exposed lenses can be used for trial case or refractometer procedures. C, By pivoting-finger movements, the spherical refraction aid will present a lens of opposite sign. D, Method of holding cylindric refraction aid. Either cylinder can be brought into a refractive position by a pivoting-finger movement. A rotary-finger movement changes the axis direction.

or cross cylindric lens or lenses mounted on shaft or handle arrangements.

Individual ophthalmologic refraction techniques provide many variations in refraction-aiding devices, regardless of whether the trial case or refractometer method is used. I have designed for my use the two refraction aids shown in figure 1, the upper aid is spherical, the lower aid cylindric.

range: a three-lens extension of +0.25 (outer), +0.50, and +0.75 diopter; the single lens adjoining the plastic or tape-wound handle has a -0.25 diopter value.

The spherical aid used chiefly for testing myopic eyes has a corresponding lens arrangement of -0.25, -0.50, -0.75 in the three-lens extension, and +0.25 diopter in the single ring.

The spherical aid is so constructed as to pivot in the fingers (see figs. 1B and 1C), thus readily presenting either minus and plus lens by a slight finger movement. This aid is used advantageously in building up or reducing spherical power. The three-lens extension makes it easy to test the eye farthest from the refractionist without undue cramping. The one-half and three-quarter diopter lenses are useful in finding spherical strength, especially in the case of patients who have poor perception and are unable to detect quarter-diopter differences.

The pair of graduated quarter-diopter spherical aids described are ample for average refractions. For amblyopic, aphakic, and high ametropic cases I use a pair of similar spherical aids having one-diopter graduations.

Figure 1 (lower) illustrates the cylindric refraction aid, with frosted areas for axis identification and oblique mounting as shown. A pivoting-circular motion with the fingers alternates either cylinder as desired, a rotary finger movement changes the axis direction (see fig. 1D). The aid used in average cases has a cylindric lens power of  $+0.25$  and  $-0.25$  diopter. For low acuity, a  $+0.50D.$  and  $-0.50D.$  combination is useful.

Refractive findings are considered complete in the average patient if further improvement does not occur when checking with: (1) the  $+0.25D.$  and  $-0.25D.$  lenses of the spherical aid. (2) The  $+0.25D.$  and  $-0.25D.$  lenses of the cylindric aid when held, (a) parallel with the axis of the patient's cylinder; (b) crossed with the axis of the patient's cylinder; (c) if the patient's final correction is spherical only, the cylindric aid's lenses have been held at two or more meridians. All this takes but a moment with the rapid use of the two refraction aids. These changes are easily understood by the patient, yet the lens repetition is

ample, without fatigue to the patient, in the elimination of any practical error.

The dexterity of the system eliminates the need of fogging on most patients not ordinarily refracted under cycloplegic, also prevents overcorrection on manifests and postcycloplegics. The shifting of many lenses in trial frame and refractometer is lessened, necessitating fewer accommodative changes and diminishing fatigue for the patient.

*Station Hospital #2,  
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## REFRACTION CLINIC\*

DISCUSSION BY ALBERT E. SLOANE, M.D.†

*Boston*

A bookkeeper, aged 24 years, had been refracted with and without drops and given glasses two months ago. He finds that he sees much better at near with these glasses but must remove them after a short while. The discomfort cannot be described specifically, but a definite sense of relief is obtained when the glasses are removed, although the vision becomes blurred. He states that near vision is most uncomfortable with and without the glasses.

He is now wearing: O.D.  $+3.25D.$  sphere; O.S.  $+3.25D.$  sphere.

*Examination:* Vision in each eye was 20/40; with a  $+3.00D.$  sphere it was 20/20.

P.P. (convergence) = 12 cm; amp. acc. 9 diopters, both eyes; adduction:  $16^{\Delta}$ ; abduction:  $8^{\Delta}$ .

Induced phorias (with glasses)—distance:  $8^{\Delta}$  exophoria; near:  $12^{\Delta}$  exophoria.

Habitual phorias (without glasses)—distance:  $4^{\Delta}$  exophoria; near:  $8^{\Delta}$  exophoria.

\* From the House Officers' Teaching Clinic, Massachusetts Eye and Ear Infirmary.

† Director of Department of Refraction.

## DISCUSSION

Without glasses, the symptoms are definitely explained on an accommodative basis because the patient must use 3 diopters of accommodation to correct his hyperopia in addition to the amount exacted for his near work. For example, if he reads at one-third meter, he uses 3D. of accommodation and he would use 3D. of accommodation to correct his hyperopia.

It may be stated roughly that for comfort in reading one should have as much accommodation in reserve as one is expending. In this case the patient is expending 6D. of the total that he possesses (9D.). Further, without glasses he has no problem in binocularity since the exophoria for distance ( $4^{\Delta}$ ) and the exophoria at near ( $8^{\Delta}$ ) are within normal limits.

Let us consider the symptoms with glasses on. When he wears his glasses, the accommodative basis for his symptoms disappears, but it is replaced by a binocular difficulty that has been induced by his new glasses. Observe that the exophoria has increased to  $8^{\Delta}$  for distance and  $12^{\Delta}$  for near. The increase in exophoria may be explained by the fact that since accommodation and convergence work together, a decreased innervation to one will favor a decreased response to the other. Without glasses he used 6D. of accommodation at one-third meter, and with glasses he used only 3D. of accommodation. The near point of convergence, 12 cm., is not good convergence ability, even though it is not poor. If his fusional convergence ability is tested it will be seen that his adduction is not high ( $16^{\Delta}$ ) although his abduction ( $8^{\Delta}$ ) is normal. It is believed that for binocular comfort a ratio of 3 to 1 between adduction and abduction is needed. If one takes into consideration the *receded near point of convergence*, the slight *lowered adduction*

ability, the *exophoria* which is *greater at near*, and *symptoms* which are *most marked at near*, a diagnosis of *mild convergence insufficiency* is valid.

## SOLUTION

The most satisfactory solution in this case would be:

- a. One that aims at correcting as much of the hyperopia as produces symptoms.
- b. To improve the convergence ability.

This is relatively easy in this case since we are dealing with a young person who has a large amplitude of accommodation. I would suggest for each eye a +2.00D. sphere, to be worn as the refractive correction and some form of exercise that would improve the near point of convergence and adduction.

A second solution—which would be more applicable in the case of an older person in which it is necessary more fully to correct the hyperopia and in which fusion exercises would be less likely to succeed—would necessitate a full correction of the hypermetropia incorporated with prism, base in, to be used only at near work (the distance correction without prisms). For example: O.D. and O.S. +3.00D. sphere with  $2^{\Delta}$ , base in, for the near-vision lens.

House Officer: "When you prescribe prisms, how much of the total amount of heterophoria do you correct?"

Dr. Sloane: "The amount of prism that one uses should be the smallest amount that will alleviate the symptoms, and this, in turn, will depend upon the nature of the work and particularly the amount of reserve duction that the patient has to compensate for that error."

H. O.: "If you were to give this man the full refractive correction with a total

of 4<sup>A</sup>, base in, would he not enjoy them for distance as well as near, since this would correct just one half of his distance heterophoria?"

Dr. S.: "I sincerely think that he could adjust himself to enjoy such glasses for constant wear but since we do not understand the side effects of prisms, I would hesitate to have him wear them for other than the relief of symptoms that exist."

H. O.: "How do you measure the near point of convergence?"

Dr. S.: "There are two methods. One, the subjective method, wherein the patient holds a card (on which there is a small dot) before the eyes, with both hands. The patient approaches the card in the mid-line until he sees two dots. In the second, the objective method, the observer notes the distance at which fixation is lost by one eye."

H. O.: "What is the normal near point of convergence?"

Dr. S.: "The average near point is 6 cm."

H. O.: "How do you measure heterophoria for near and at what distance?"

Dr. S.: "I use the displacing prism method with a dot at 16 inches."

H. O.: "Why do some writers maintain that a knowledge of the lateral ductions is more important than a knowledge of the amount of lateral heterophoria?"

Dr. S.: "The ductions are the potentials which neutralize the errors of imbalance so that if the ductions are high enough the amount of heterophoria is not

significant, since it will be corrected by the ductions. I personally think it is important to know both."

H. O.: "Will the prismatic effect of improperly centered strong correction lenses give a false phoria reading?"

Dr. S.: "Yes; but we assume that whenever the phoria test is made the lenses are as centrally and accurately placed as possible."

H. O.: "Is it ever necessary to test phorias in positions other than that of primary gaze?"

Dr. S.: "Yes. This is especially true in hyperphoria and in all cases in which a paresis is suspected."

H. O.: "What are the normal limits of exophoria?"

Dr. S.: "The amount of exophoria considered as normal and which can be tolerated without symptoms vary. One may consider up to 6<sup>A</sup> normal for distance and 10<sup>A</sup> normal for near."

H. O.: "Do you measure duction at near or at distance or both?"

Dr. S.: "It depends upon how deeply I am investigating the muscle status. In most cases I would only do it for distance."

H. O.: "Why are there often no symptoms when the exophoria is very high?"

Dr. S.: "Nature is a great compensator. When the fusion sense is inadequate to neutralize a high heterophoria, one learns to suspend central vision of one eye, thereby eliminating symptoms of poor binocular fixation."

# SOCIETY PROCEEDINGS

EDITED BY DR. RALPH H. MILLER

## CHICAGO OPHTHALMOLOGICAL SOCIETY

SANFORD GIFFORD, *president*

November 17, 1941

### CLINICAL MEETING

(Presented by Department of Ophthalmology, University of Illinois)

#### CIRCUMPAPILLARY CHOROIDITIS

DR. ROOSEVELT BROOKS said that M. S., a woman, aged 31 years, was first seen in Research Hospital Eye Clinic on November 1, 1941, complaining of poor vision in the right eye for two years, and dizziness, headache, and vomiting for four weeks. She gave a history of sudden loss of vision in the right eye following an operation on one kidney two months previously. She had never had pain in her eyes.

Serologic and laboratory tests gave negative results.

Examination of the eyes showed vision R.E., no light perception; L.E., 1.0+3. The pupil of the left eye reacted to light and accommodation; the fundus of the left eye showed no pathology. The pupil of the right eye did not react to light and accommodation. The fundus showed a large white area around the disc, including the macula and extending nasalward about 1D.D., with clumps of pigment scattered throughout. The retinal vessels passed over this area without interruption. The disc was indistinct and atrophic, being greenish-white in color. In the region of the macula a small red area, apparently a small hemorrhage, was seen. The retinal vessels were normal.

The etiology in this case is, as yet, undetermined. Syphilis and tuberculosis are possible causes.

#### BILATERAL NUCLEAR CATARACT; BILATERAL MACULAR DEGENERATION; VITREOUS FLOATERS

DR. ROOSEVELT BROOKS said that H. McC., a man aged 60 years, gave a history of poor vision for as long as he could remember. He had worn glasses since the age of seven years, but with only slight improvement of vision. Four years ago his vision became more blurred, and had progressively failed since that time.

Physical examination showed nothing abnormal except slight impairment of hearing. Blood pressure was 132/90. Serologic and laboratory tests showed normal findings.

#### Vision:

R.E. 3/200; w. manifest -7.50D. = 5/200

L.E. 2/200; w. manifest -5.50D. = 4/200

The external ocular movements were normal. The corneas were clear, the anterior chambers normal. The pupils reacted to light and accommodation; there was no nystagmus. The lenses showed nuclear opacities. The vitreous was fluid, with a few fine floaters in the right eye, and many coarse floaters, one a veil-like membrane, in the left eye.

In each macular region there was a round, white, atrophic area measuring about 1.5D.D., with pigmented margins. A few vessels were seen to pass through the area. There was a smaller, atrophic area along the superior nasal vessels in the right eye. The disc outlines were indistinct.

#### MICROPTHALMIA; PERSISTENT HYALOID ARTERY; TUNICA VASCULOSA; HIGH MYOPIA

DR. MARTHA R. FOLK said that V. L. G., a white girl, aged five years,

was brought to the clinic on September 24, 1941, with a complaint of poor vision since birth. The mother stated that she was a full-term child of normal development except for the eyes. When she was one month old, jerky movements of the eyeballs were noted; later she stuttered and made nervous purposeless motions; she would often walk in circles.

General physical examination gave essentially normal findings. Serologic and laboratory studies were negative. The child appeared to be intelligent.

**Vision:**

R.E. = counts fingers at one meter.

L.E. = light perception and projection.

Atropine refraction revealed a myopia of R.E.  $-19.50D.$  and L.E.  $-20.00D.$ , not improved with glasses.

A small, pigmented mole, 6 by 8 mm. was seen on the skin of the right lower lid near the inner canthus. There was tilting of the head in the direction of gaze, with a searching movement of the eyes. The upper lid showed a lag. The nystagmus was of the mixed horizontal-vertical type. There was bilateral microphthalmia, the left eye being somewhat smaller. The eyes rotated fully in all directions. The pupils reacted to light and accommodation.

The iris was hazel in color in each eye. Vitreous floaters were present in both eyes.

The cornea of the right eye measured 10 mm.; the pupil was 4 mm. in size. The disc was pale, somewhat larger than normal, and the margins faded away at its edges; from the disc a frail, grayish, funnel-shaped membrane protruded into the vitreous and attached itself to the temporal and posterior pole of the lens.

The cornea of the left eye measured 9.5 mm. in diameter; the pupil was 3 mm. in size. The disc was round, slate-gray, sharply bordered, and no blood vessels were visible. A membrane was seen on the temporal side of the lens, posteriorly. The eye converged 20 degrees.

Details of the fundi were not visible. An occasional blood vessel was seen in the fundus of the right eye, none in the left. Extensive spots of choroidal pigment could be faintly seen.

**FIELD CHANGES IN CARBON DISULFIDE POISONING**

DR. EDWARD J. HORLICK said that T. L., a man aged 38 years, was referred from the occupational-disease clinic. His complaints were epileptiform seizures, ir-

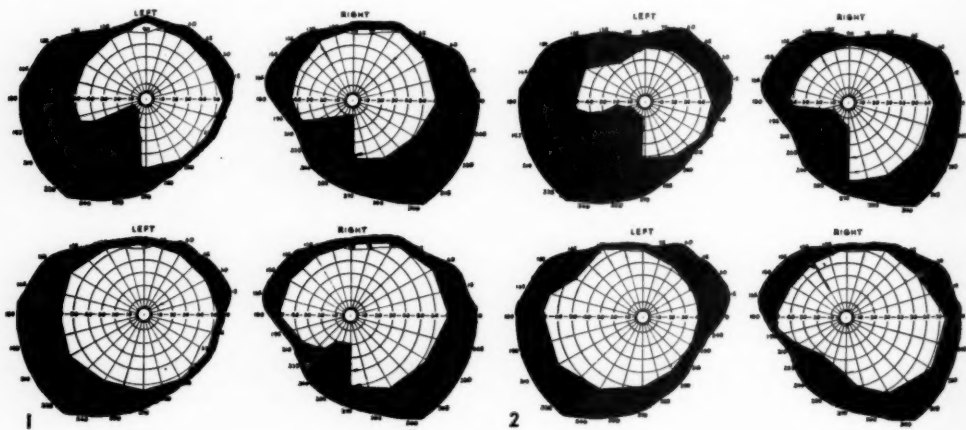


Fig. 1 (Horlick). Upper: visual fields as of June 10, 1941. Lower: fields on August 7, 1941.  
Fig. 2 (Horlick). Upper: visual fields as of September 9, 1941. Lower: fields on October 9, 1941. Target, 5 mm.

ritability, and generally reduced energy. The patient had been employed in the manufacture of rayon yarn, and had therefore been exposed to carbon disulfide poisoning.

Vision in each eye was 1.2. Results of examination of the eyes were negative except for homonymous quadrantanopia. Upon neurologic examination it was said that a brain tumor could be present, but the lesion could not be definitely localized. The patient remained away from work for several weeks, with improvement of the field defects, but upon resuming work the quadrantanopia returned. After another rest period the field defects again disappeared; a general form-field contraction remains. No disturbance in color fields has ever been present (fields shown herewith). The patient has been dismissed from his work and the condition has shown slow improvement.

The pathology of carbon disulfide poisoning is extensive degeneration of the cranial nerve cells and peripheral nerve trunks. In 71 percent of cases mental disturbances occur, from simple depression to manic depressive insanity. The auditory nerve is affected in 54 percent, the optic nerve in 54 percent, and the heart and blood vessels in 38 percent. Marked interference with the sexual function is usual. The eye findings are valuable diagnostic aids because many of the other symptoms are subjective. Nystagmus, loss of the corneal reflex, pupillary disturbances, changes in the discs, enlargement of the blind spot, and field defects are found.

#### CENTRAL CHORIORETINAL DEGENERATION

DR. HALLARD BEARD presented C. M., a woman, aged 24 years, who had had poor eyesight since childhood; she believes since an attack of measles at the age of eight years.

Vision, R.E. 3/200; L.E. 6/200. The pupils were active; there was no nystagmus. The central fundus of both eyes was involved in pigment changes, characterized by thinning and granulation of the pigment in large roundish, sharply defined, but confluent areas, most marked in the right eye, and between the disc and fovea in both. The foveas were recognizable. The discs exhibited only slight pallor on the temporal side, and had good capillary circulation. The retinal vessels were normal. The peripheral fields were normal except for a 30-degree contraction in the upper and outer portion of each. There was no red perception in the right eye; central fields were not obtained. Examination of the eyegrounds with red-free light showed the yellow pigment of the macula lutea to be present in both eyes, somewhat thinned and scattered in the right.

Refraction under cycloplegia gave the following:

R.E.  $-50D.$  sph.  $\oslash +2.50D.$  cyl. ax.  $120^\circ$   
L.E.  $+1.00D.$  sph.  $\oslash +1.25D.$  cyl. ax.  $90^\circ$

The correction did not improve the vision. The etiology has not yet been determined. Serologic tests are negative. The patient appears to be in good health. The opinion is that the condition resulted from a diffuse central choroiditis in childhood, possibly of tuberculous nature.

#### COLOBOMA OF THE OPTIC-NERVE ENTRANCE

DR. CARL APPLE presented R. H., a 19-year old boy, who came to the clinic with a right convergent strabismus of 25 degrees and a coloboma of the right optic nerve entrance. The disc was about four times the normal size; the greater number of the retinal vessels emerged from the pit at the lower part of the coloboma, others from the upper aspect.

FURTHER STUDIES CONCERNING HOMATROPINE CYCLOPLEGIA AND PAREDINE, WITH SPECIAL REFERENCE TO THE RATE OF ACCOMMODATIVE RECOVERY

WILLIAM F. MONCREIFF and KARL J. SCHERIBEL presented a paper on this subject which was published in this Journal (July, 1942).

*Discussion.* Dr. G. H. Mundt said that it is always a pleasure to find that a carefully worked-out study such as this bears out one's own conclusions. There are certain individuals for whom one uses homatropine with the addition of paredrine, and in whom a mild spasm of accommodation is induced. He asked why a mild anesthesia is used before instillation of homatropine. He had no difficulty with private patients; in fact, pontocaine apparently is more irritating than homatropine.

Dr. Carl Schaub asked whether there is any evidence as to comparative recovery time if eserine or other similar drugs were used.

Dr. Karl J. Scheribel (closing) said that when the study was started, pontocaine topical anesthesia was used before instillation of the adrenergic drugs, chiefly in order to allow the medication to be instilled at the superior limbus, so that it could flow over the cornea; also, the benzedrine used in the early part of the study was quite irritating to the eye. The same routine was continued in the second study, even though paredrine does not cause irritation.

Dr. William F. Moncreiff (closing) said that the studies revealed that paredrine neither adds to the efficiency of homatropine cycloplegia nor facilitates

recovery from it. Paredrine is only a mydriatic and, when used in conjunction with homatropine, merely increases dilation of the pupil, which may be of value in the aged, but is certainly undesirable in the young. With the present scarcity and high price of euphthalmine, paredrine is an acceptable substitute.

In reply to Dr. Mundt, no evidence of spasm of accommodation was observed following the use of paredrine. For obvious reasons, miotics were not used.

CORNEAL TRANSPLANTATION (KODACHROME SLIDES AND MOTION PICTURES)

RICHARD A. PERRITT presented this topic.

CILIA IMPLANTATION INTO ANTERIOR CHAMBER THROUGH TRAUMATIC CORNEAL PERFORATION

JACK P. COWEN presented a paper on this subject which has been published in this Journal (June, 1942).

*Discussion.* Dr. Martha B. Lyon said that in the case she reported in the American Journal of Ophthalmology (1940, v. 23, April, p. 451), the cyst with the cilium attached did not appear until a year after the injury. The cyst then grew so rapidly that loss of the eye seemed probable.

With a keratome an incision was made at the lower margin of the cornea. The cyst was firmly adherent to the iris and the posterior wall of the cornea. The cyst was freed below with small iris scissors and above with a small, blunt hook, then the cyst with cilium attached was removed with a cataract loop. The eye has entirely recovered. Robert Von der Heydt.

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## CYCLODIATHERMY

In the past third of a century, the possibilities for surgical relief of glaucoma have been enormously increased. Graefe's iridectomy, in spite of brilliant successes in the acute congestive type of glaucoma, usually afforded little or no permanent benefit in the chronic type. It is a significant fact that the acute congestive type has gradually assumed a less dominant place in textbook descriptions of the disease. Most of the congestive cases probably represent acute intensification of the glaucoma process in eyes whose glaucoma had not been previously recognized or had received inadequate attention. Greater watchfulness for the chronic or noncongestive form or stage of the dis-

ease, and widespread use of the tonometer in conjunction with other means of diagnosis, have led to more frequent recognition of the earlier stages, with resulting medicinal or surgical control.

Apart from iridectomy, four principal surgical procedures have been used widely and with great benefit in many cases. These are, Lagrange's sclerecto-iridectomy, Elliot's trephining, Holth's iridencleisis, and Heine's cyclodialysis. The first three are closely related, particularly as to their capacity for utilizing uveal tissue in the formation of new channels of communication between the interior and the exterior of the eye; and, as pointed out by Holth, it is probable that the same factor has often played an important part in the

benefits obtained from iridectomy. Yet on the whole very little is known with certainty as to the mode of action of these various operations when successfully performed.

Some years ago, L. Weekers (*Archives d'Ophthalmologie*, 1931, volume 48, page 593) described a series of experiments, chiefly upon animal eyes, from which he concluded that after any form of operative procedure for glaucoma the essential factor was a change of intraocular circulation caused by traumatism to the anterior portion of the uveal tract.

Forms of traumatism in Weekers's experiments included subconjunctival injection of caustic materials, superficial cauterization of the sclera with the electric cautery, and orbital injection with various substances. Eyes thus traumatized showed always a primary hypertension followed by more prolonged hypotension.

Upon the basis of the rate of passage into the eye of fluorescein which had been injected into the general circulation, Weekers concluded that both these phases were due to vasodilatation, which in the first place increased the secretion of aqueous and in the second place hastened the removal of that aqueous from the eye.

The Belgian writer admitted and still admits (L. Weekers and R. Weekers, *Ophthalmologica*, 1942, volume 104, page 1) that complete explanation of the mechanism of the various glaucoma operations has not been accomplished. It might also be suggested that any such experiments as those which Weekers and others have performed upon the lower animals are open to the criticism that the eyes were in the first place normal and could therefore hardly be expected to behave like glaucomatous human eyes.

The new Weekers essay considers more particularly the use of multiple diathermy puncture for desperate cases of glaucoma. The diathermy operation may be

supposed to produce effects very similar to those demonstrated after galvanocauterization. In the Weekers experiments, exact measurement and recording of the amount of current employed was secured with the Léon Coppez apparatus.

It was found that the final results obtained were of the same character and subject to the same general principles, whether the current was applied with needles that penetrated the sclera or with a nonpenetrating electrode 2 mm. in diameter. The intensity of the effect was more marked and more prolonged when the treatment was applied over or in the immediate vicinity of the ciliary body, although definite hypotonic effects were had from application at any part of the sclera.

It will be recalled that Albaugh and Dunphy (*Archives of Ophthalmology*, 1942, volume 27, page 543) have recently spoken favorably of nonperforating cyclo-diathermy particularly as avoiding the complications incidental to opening of the eyeball, such as hemorrhage, secondary infection, and sympathetic ophthalmia.

In penetrating cyclo-diathermy, the primary hypotension is chiefly due to the escape of aqueous humor through the puncture holes. In animal eyes, Weekers and Weekers did not find any essential difference between the hypotony ultimately obtained with the two methods, penetrating and nonpenetrating. But in a limited number of cases of absolute glaucoma in human beings it seemed possible to obtain a sufficient amount of hypotony, with less disturbance and fewer risks, by the use of the perforating method. The effect is more or less proportional to the number of perforations or applications, that is, to the area of ciliary body over which the operation has been performed.

The experimental material studied by the two Belgian authors indicated that the dominant change in the eyeball after cyclo-diathermy was an enormous vaso-

dilatation of the uvea, including the iris and choroid. If diathermization was intense, exudative phenomena were produced, including extravasation of blood and actual hemorrhages into the tissues.

In animal eyes the hypotony obtained from cyclodiathermy was always transient unless the effect produced was so severe as to lead to the permanent hypotony associated with atrophy of the eyeball. In the human material reported upon by various authors, this critical borderline between undereffect and overeffect does not appear to play quite so important a part.

Experimental use of the nonperforating type of cyclodiathermy, in human eyes which were doomed to enucleation, suggested that excessively heavy dosage increased the risk of intraocular hemorrhage, and that the reduction in tension was proportional to the amount of uveal atrophy produced (including atrophy of the iris). Other complications which may arise from overdosage are cataract, choroiditis, and retinal detachment.

Weekers and Weekers agree with Albaugh and Dunphy, and with other writers, that the technical simplicity of cyclodiathermy favors this operation for cases in which it is particularly undesirable to open the eyeball, as for example in hemorrhagic glaucoma.

Weekers and Weekers, however, suggest that their comparative study of iris incarceration on the one hand, and cyclodiathermy on the other, is distinctly in favor of incarceration, which they employ in the form of Lagrange's iridosclerectomy. The minor mutilation of the eyeball involved in the incarceration procedures has proved capable of producing pronounced reduction in tension, whereas with diathermy an equal effect can only be obtained by making the operation so extensive as to endanger the integrity of the globe.

It is hardly to be supposed that all the possibilities of glaucoma surgery have been exhausted. Cyclodiathermy has been resorted to chiefly in desperate cases, where there was little or no hope of recovering sight and where the purpose was to retain a comfortable although blind eyeball. Success in the use of cyclodiathermy apparently depends upon producing sufficient, and not too much, atrophy of the ciliary body. It is not impossible that similar results will be obtained without cauterization, by the use of cutting instruments in such a way as to cause definite injury to the superficial layers of the ciliary body. In at least one case of high intraocular tension, apparently secondary to a traumatic vascular lesion of the fundus (the ophthalmoscopic view being rendered impossible by opacity in the vitreous) the present writer was able to produce lasting benefit by a shelving subconjunctival incision passing through the angle of the anterior chamber and cutting through the superficial layers of the ciliary body to emerge from the sclera well back of the limbus.

W. H. Crisp.

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#### THE McMILLAN HOSPITAL

Several important matters are awaiting editorial comment, but when the mind is almost completely occupied with one thought and every possible minute devoted to the accomplishment of one object, it is nearly impossible to marshal one's ideas to think long and coherently enough about something else to develop the subject satisfactorily. For this reason the writer has no choice but to write about the McMillan Eye, Ear, Nose, and Throat Hospital, now nearing completion in Saint Louis. One might well add, at long last; for many years have passed since the conception of the project. A

brief history might be of interest to Journal readers.

Just after the turn of the century, the need of an eye, ear, nose, and throat hospital in Saint Louis was presented by their ophthalmologists to Mr. William McMillan, at that time president of the American Car and Foundry Company, and to his wife. The suggestion was favorably received and a will was accordingly drawn, leaving an estate of approximately one million dollars to Washington University for the construction of such a hospital, if the only son, their only direct heir, should die without issue.

This estate became available shortly after the first World War, but it was deemed best by the University to hold the funds until the total had increased to about a million and a quarter dollars. This occurred about 1928. Plans were drawn to include in the same building an Institute for Research in Ophthalmology and Otolaryngology which was to occupy the five upper stories.

The building was accordingly constructed in the group associated with the Washington University School of Medicine. As built there were 13 stories. The basement was designed for an otolaryngologic clinic; the ground floor for an ophthalmic clinic; the second floor for operating rooms, lecture hall, and the board of directors' room. The third to the seventh floors were planned for the hospital, and the eighth to the twelfth, as stated, for the Oscar Johnson Institute. Above the twelfth floor were squash courts and a recreation room, commanding a magnificent view of the southern part of the city and its surroundings. Glimpses of the Mississippi can be caught to the east, and the foothills of the Ozarks to the south and west.

The clinics and Institute were completed in 1929, and have been in active use ever since, but, as everyone too well knows, the unstable business structure

of the country began to crumble in 1929 and continued to fall about us for the next 10 years. Caught in this catastrophe, investments dwindled, and the hospital floors could not be completed and equipped.

Years rolled by. Better times came, and with the advent of World War II business assumed increased activity, so that hospital-bed capacity of the Saint Louis area was taxed beyond the limit of efficiency. The logical step was for the Barnes Hospital to take over the conduct of the McMillan Hospital if funds could be found to complete the building. This the trustees of Barnes Hospital agreed to do, it being recognized that conduct of the two hospitals as one unit would be far more economical than carrying on each separately. To utilize the already built McMillan Hospital would also save considerably over adding floors to any building of the Barnes Hospital group.

At this time it became possible to get a Government grant to complete and equip the unfinished floors.

A few years ago, through a gift from the Rockefeller Foundation, a neuro-psychiatric department had been added to the Washington University Medical School, but no definite rooms were available for the patients from this department. For the time being, only three floors, which will accommodate approximately 115—50 ward and 65 private patients—seem necessary for the use of ophthalmology and otolaryngology, so two floors with 20 beds each are to be used by neuro-psychiatry until needed by the eye, ear, nose, and throat departments.

The present difficulty centers around priorities and actual lack of material and equipment. The new hospital certainly cannot start as a dream of perfection, but it will be a beginning—a long-awaited consummation of an idea. Even if not

completed just as planned, it will fill a long-felt need.

The ideal hospital for ophthalmic patients should be a specialty unit but should not be divorced from the medical, surgical, and other branches of the profession because the full development of each specialty can be attained only in close co-operation with general medicine and all other specialties. On the other hand, ophthalmology receives scant attention in the general hospital. The nurses are poorly trained to handle eye cases and are quite uninterested in them. They are not sufficiently dramatic and there is too much detail, much of which seems unimportant to nurses. It is even difficult to keep the ophthalmic dressing-room equipment in good condition, and in most general hospitals special instruments, such as perimeters and slitlamps, are inaccessible. In many hospitals ophthalmic operations must wait on other surgery. In all of these and other particulars the eye patient suffers. Hence the value to the patient of the change from general to special hospitals. In some hospitals it has been possible to concentrate all ophthalmic cases in a single unit. This, of course, offers the same advantages as the specialty hospital; that is, if operating room and clinics are equally concentrated—but usually this arrangement is impossible, and the ophthalmologist must walk long distances to care for his patients.

One of the benefits of an eye hospital is the possibility of concentration of varied pathology, and it is hoped that this will prove of great value in the instruction of ophthalmology in the Saint Louis area.

Lawrence T. Post.

### BOOK NOTICES

**THE ART OF SEEING.** By Aldous Huxley. 273 pages. New York and London, Harper and Brothers Publishers. 1942.

From the context the reader judges that the author has had defective vision since the age of 16 years, owing primarily to corneal scars resulting from a punctate keratitis. He apparently went through several stages in his reactions to his ocular disability. At first, there was discouragement, followed by an intense effort to see as clearly as possible, and then an abandonment of such effort, having exhausted the possibilities as presented by the ophthalmologists whom he consulted. Many years later, he encountered a student of the late Dr. Bates, who taught him to utilize to better purpose the sight that remained to him.

The thesis of his book is that the usual practice of ophthalmologists confines itself to the mechanics of vision and does not concern itself sufficiently with the physiology and psychology of the subject. There is much discussion of these elements in seeing, with great detail as to the methods advocated by Dr. Bates together with some additions from the author's own experience. He dismisses the discussion of the mechanical factors by the statement that he is not qualified to comment upon them, writing merely that he concludes that there is something of truth in the arguments of both the orthodox ophthalmologists and of Dr. Bates.

He believes that those with defective vision defeat their own purpose by an over-effort to see, and much of his advice is toward overcoming staring. He also urges training the eye to overcome avoidance of high illumination. He himself is convinced that his ability to see has been greatly increased. This might be true in his case even if his actual ability to read test charts were not proportionately improved. The weakness of the argument is the attempt to apply the method universally. To do so would not only be absurd in some cases, but dangerous.

Ophthalmologists rejected the Bates

theories in their entirety, largely because of the incompatibility of the mechanical assumptions with proved facts. If Dr. Bates had confined himself to encouraging and training the use of defective eyes, some of his suggestions might have been accepted, but his program was so encumbered with deductions that most ophthalmologists and physicists believe to be incorrect that all of his ideas were rejected.

The reader of this book is convinced of the author's sincerity, but cannot help being apprehensive lest the introduction of unsound ideas counterbalance any good that might be accomplished by the book.

Lawrence T. Post.

**OFTALMOSCOPIA CLINICA, MANUAL PRACTICO PARA MEDICOS Y ESTUDIANTES** (Clinical ophthalmoscopy, practical manual for physicians and students). By Tomás R. Yanes, Instructor in Ophthalmology, Medical Faculty, University of Havana. Paper covers, 500 pages, 14 color plates, 221 illustrations in the text. Biblioteca Medica de Autores Cubanos, Havana, Cuba, 1943. Price \$6.00 (Cuban).

This is an able presentation of the subject, by a Cuban author who has become fairly familiar to American ophthalmologists during his visits to the United States, and whom we respect for his ability to present clearly and forcefully any subject upon which he speaks.

Yanes and his publisher are not quite agreed as to the purpose of the book. The former positively states that it has been prepared exclusively for the practicing physician, to whom it aims to teach the use of the ophthalmoscope, "an instrument as indispensable as the stethoscope, the sphygmomanometer, and the percussion hammer." The publisher's announce-

ment, on the other hand, offers the book "to the medical student, to the general physician, to medical specialists, to neurologists, to internists, and to ophthalmologists." Many authors must have applied to their publishers the familiar saying: "Preserve us from our friends!"

The book is based upon a course given by Yanes to Cuban physicians other than ophthalmologists, in connection with the Eighth (Cuban) National Medical Congress. Self-instruction in ophthalmoscopy is entirely possible, although no doubt rare. So clearly and interestingly arranged are the earlier chapters of the present volume, that from its teaching the physician entirely ignorant of ophthalmoscopy could learn the use of the instrument and acquire familiarity with the appearance of the normal eye, as well as with some of the more frequent variations from the normal. In a later edition the author might find it advisable, from this point of view, to add a few more explicit details as to the exact direction of the patient's gaze, and what the beginner should first look for when he starts to examine the eye with the ophthalmoscope.

The later chapters of the book hardly bear the stamp of being addressed to the beginner, but suggest an attempt by the author to cover the whole field of ophthalmoscopy, to an extent which would certainly be embarrassing to a novice.

The volume is profusely illustrated. Some of the black and white illustrations are excellent. The best illustrations are a series of color plates, 13 in number, perfectly reproduced from Oeller's Atlas. The great bulk of the illustrations are reproductions, sometimes not very clearly printed, from black and white photographs of the fundus. These include a number of conditions, some of them rare, of which photographs were furnished to the author by workers in the United States and other countries. For the ex-

perienced ophthalmologist, most of these fundus photographs might have sufficient interest to justify their use in spite of poor reproduction. But for the student and general practitioner to whom the book is especially addressed, the majority of such photographs would be of little advantage, and would, in fact, prove baffling by their vagueness.

For the beginner, at least, the color plates of the fundus which are to be found in the best "atlases" are greatly superior to fundus photographs, especially those in black and white. For the student and general practitioner, it would have been better if Yanes had included a larger number of the Oeller plates and had omitted most of the fundus photographs; although this of course would have materially reduced the size of the volume. One is a little surprised to find no list of the 235 illustrations.

In the main, however, Yanes's "Clinical ophthalmoscopy" is a laudable and suc-

cessful effort toward widespread understanding of ophthalmoscopy by Cuban and other Spanish-American general physicians. The text of the volume is well printed and carefully edited. It may be worthy of note that this volume is one of a series of ten to be issued under the direction of Yanes and his colleague Vicente Banet Pina with the general title of "Biblioteca médica de autores Cubanos."

W. H. Crisp.

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## CORRESPONDENCE

DOSAGE FOR ERYTHROL TETRANITRATE

Editor,

American Journal of Ophthalmology:

It has been called to my attention that the dosage given for erythrol tetranitrate in my article in the February issue of the Journal is printed as one-half gram. It should be one-half grain.

(Signed) L. C. Ravin.

# ABSTRACT DEPARTMENT

EDITED BY DR. WILLIAM H. CRISP

Abstracts are classified under the divisions listed below, which broadly correspond to those formerly used in the Ophthalmic Year Book. It must be remembered that any given paper may belong to several divisions of ophthalmology, although here it is mentioned only in one. Not all of the headings will necessarily be found in any one issue of the Journal.

## CLASSIFICATION

- |  |  |
|--|--|
| 1. General methods of diagnosis                        | 10. Retina and vitreous                                |
| 2. Therapeutics and operations                         | 11. Optic nerve and toxic amblyopias                   |
| 3. Physiologic optics, refraction, and color vision    | 12. Visual tracts and centers                          |
| 4. Ocular movements                                    | 13. Eyeball and orbit                                  |
| 5. Conjunctiva   | 14. Eyelids and lacrimal apparatus                     |
| 6. Cornea and sclera                                   | 15. Tumors   |
| 7. Uveal tract, sympathetic disease, and aqueous humor | 16. Injuries   |
| 8. Glaucoma and ocular tension                         | 17. Systemic diseases and parasites                    |
| 9. Crystalline lens                                    | 18. Hygiene, sociology, education, and history         |
|  | 19. Anatomy, embryology, and comparative ophthalmology |

### 1

#### GENERAL METHODS OF DIAGNOSIS

Cotlier, I. **Ophthalmoscopy with the yellow sodium light.** *Anales Argentinos de Oft.*, 1941, v. 2, Oct.-Nov.-Dec., p. 198.

After discussing the physics of light, Cotlier describes the sodium lamp of Kleefeld and its construction. With this monochromatic light the nerve head appears yellow and the nerve fibers as fine stripes. Blood vessels are black and the finest ramifications may be easily followed. The smallest hemorrhages are readily visible and the choroidal circulation is much better visualized than with ordinary light. Retinal detachment and holes at the macula can be studied with the yellow light. (3 figs.)

Eugene M. Blake.

Duggan, W. F. **Tangent-screen scotometry in office practice.** *New York State Jour. Med.*, 1942, v. 42, Oct. 1, p. 1842.

The author makes a plea for the use of the tangent-plane screen, because it lends itself so well to quantitative sco-

tometry. On the screen a 0.5-mm. test object at one meter subtends an angle of  $1/35$  degree, whereas on an ordinary perimeter at 330 mm. the angle is  $1/12$  degree. To obtain  $1/35$  degree on a perimeter the test object would need to be  $1/6$  mm., less than the thickness of the edge of a card. The literature pointing out the advantages of the method is reviewed. Of course colors are also used with this method. Duggan says that in confirming a diagnosis of glaucoma and in making a prognosis, he considers the tangent screen more important than the tonometer. He contends that in outlining small scotomas and detecting early lesions a far higher degree of precision can be attained than with any perimeter on the market.

The author deprecates the relegation of field-taking to nurses and technicians, and believes that our residents should be given far more intensive training in this procedure. He takes all his own fields and says that the tangent screen is used for testing about nine percent of his patients—one half ophthalmological and one half referred from other specialties. Duggan believes

he can confirm the statements that have been made in textbooks that in choroidal lesions the defect for blue and yellow is relatively greater than for red and green, and that the reverse is true in retinal and optic-nerve lesions. But Evans, in discussing the paper, states that he believes this cannot be demonstrated or proved. A discussion of fields in various pathologic entities is given. A large number of basic data are given that cannot be well abstracted, but which could well be read by physicians and technicians interested in tangent-plane scotometry.

Evans, in discussion, favors shorter distances and says he has evidence to show that the shorter-range instruments are more accurate because of the reduction of the path of fixation movements. He also disagrees with Duggan's statement that in gross field defects the confrontation test is almost as accurate as the perimeter. (10 references.)  
Ralph W. Danielson.

Wolff, Eugene. **Cholesterin spaces in celloidin sections.** *Trans. Ophth. Soc. United Kingdom*, 1941, v. 61, p. 77.

The author describes rhombic crystals of cholesterin which were found in a blind, painful eye when bisected. After dissolving in ether they took the form of needles. Thus the spaces left in celloidin preparation are oval, surrounding the needle-form crystals.

Beulah Cushman.

## 2

### THERAPEUTICS AND OPERATIONS

Crisp, W. H. **Hints on therapeutic routine.** *Ophth. Ibero-Amer.*, 1942, v. 4, no. 1, pp. 5-10 (in English) and pp. 11-15 (in Portuguese).

Therapeutic details dealt with include the following: technique for in-

stillation of collyria; the fact that undesirable effects from use of atropine and homatropine in refraction are usually found to have occurred when the stomach was empty of food, the lesson being that the patient should come for such cycloplegia shortly after a fairly substantial meal; the importance of the patient using atropine or similar drug at home as well as having it instilled in the doctor's office in many cases of iritis or corneal disturbance; the necessity for constant watchfulness as to the appearance of atropine intoxication around the eye; the advisability of trial instillation of hyoscine in the office before trusting the patient with it at home; the advantage of using pilocarpine, in strong solutions if necessary, as often as possible in place of eserine; use of 0.5 percent of pontocaine hydrochloride in combination with optochin hydrochloride for pneumococcus conjunctivitis, to avoid persistent pain from instillation of the latter drug; the folly of attributing to the use of dionin a progressive clearing of corneal opacities, which often continues to a remarkable degree, without any treatment, for years after ocular injury; the occasional use of radium for destroying a few intumed eyelashes which chronically irritate the eye; the undesirability of routine use of carbolic acid in cauterization of corneal ulcers, the penetrating effect of this drug being likely to result in permanent opacity; advantage of the use of pure nitric acid in very small quantity on the end of a toothpick for sterilization of corneal ulcers, in place of trichloroacetic acid; the advantages, and absence of disadvantage, in the open method of treating slight corneal injuries, that is omission of occlusive dressings, so as to permit home treatment with drugs or hot compresses.  
W. H. Crisp.

Scheineson, L. M. **Ophthalmic ointments.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 171-178.

## 3

PHYSIOLOGIC OPTICS, REFRACTION,  
AND COLOR VISION

Brown, E. V. L. **Use-abuse theory of changes in refraction versus biologic theory.** *Arch. of Ophth.*, 1942, v. 28, Nov., pp. 845-850.

The use-abuse theory of changes in refraction considers that school work, convergence-accommodation, poor lighting, and so on are responsible for the changes. The biologic theory attributes the changes to heredity and growth. The author has studied the refraction changes of 1,737 persons under repeated atropinizations and has computed the net average change in refraction. An even, regular, and uniform curve is found when these data are charted. There is a steady increase in hypermetropia each year until the end of the sixth year. A change toward myopia begins during the seventh year and continues at a high rate until the age of 14 and then slows down. After twenty years there is practically no change. The patients examined under atropine after the age of 31 years were too few to consider in the study. The curve found suggests that the refractive changes after the age of seven years are the result of factors that control growth. The result therefore supports the biologic theory. The increase in hypermetropia up to the end of the sixth year disagrees with the usual view that hypermetropia decreases after birth. (One curve, 2 tables, references.)

John C. Long.

Butler, T. H. **Uncommon symptoms of migraine.** *Trans. Ophth. Soc. United Kingdom*, 1941, v. 61, p. 205.

The author suggests that a comparatively small number of headaches have an ocular basis, in spite of the almost universal belief that errors of refraction and muscle imbalance cause headache and asthenopia. A headache of recent origin should be due to a recent cause. An ocular defect present for many years is unlikely to exert a malign influence unless there is such an added factor as overstudy, work under bad conditions, debilitating disease, or psychic disturbance.

The author gives his own history of headaches which for many years he did not diagnose as migraine. As a young man he had occasional severe headaches, then several acute attacks of polyuria lasting about three days with a dry mouth, but no undue thirst: the specific gravity of the urine was often as low as 1,000. Scintillating scotoma had been noted, and of the macular type, the rate of the shimmer about nine to the second. Diplopia has been present at intervals, and labyrinthine vertigo. All these attacks were followed by a dull feeling in the head. Diplopia was of two varieties, one probably of central origin and the second caused by transient paresis of a muscle innervated by the third pair. Butler has found his own experience duplicated in part in many patients with atypical migraine.

Beulah Cushman.

Doggart, J. H. **Refraction under war-time service conditions.** *Trans. Ophth. Soc. United Kingdom*, 1941, v. 61, p. 179.

Refraction is the largest branch of eye work in the defense services. It must often be carried on in outlying stations in which facilities must be improvised, and as large a number of patients as possible examined in a

minimum length of time. Patients should feel at ease, the questions should be simple and unambiguous. The subjective test should not be prolonged, but mydriasis ordered. Retinoscopy is not needed if the subjective test is conducted with care.

Records of visual acuity on entry into the services are vitally important when the extent of sight loss is to be assessed in men whose disability may be attributable to injury or disease resulting from service duties.

Beulah Cushman.

Gallagher, J. R., Gallagher, C. D., and Sloane, A. E. **A brief method of testing color vision with pseudo-isochromatic plates.** *Amer. Jour. Ophth.* 1943, v. 26, Feb., pp. 178-181. (4 tables.)

Gipson, A. C. **Treatment of eyestrain with vitamin-B complex.** *Jour. Med. Assoc. State of Alabama*, 1942, v. 11, Feb., p. 265.

Gipson reports a series of cases in which vitamin-B complex was given to relieve eyestrain. Of 25 patients, 20 were relieved of all symptoms. It is advised that all children with eyestrain but with no refractive error be given vitamin-B complex and put on a high vitamin diet before glasses are prescribed.

Gertrude S. Hausmann.

Jackson, Edward. **Practical importance of aniseikonia.** *Amer. Jour. Ophth.*, 1943, v. 26, Jan., pp. 18-20; also *Trans. Amer. Ophth. Soc.*, 1942, v. 40.

Luckiesh, M., and Moss, F. K. **Effects of astigmatism on the visibility of print.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 155-157. (2 figures.)

Mueller, Frederico. **The practical significance of dyschromatopsia.** *Ar-*

*quivos Brasileiros de Oft.*, 1942, v. 5, Oct., pp. 251-258.

The author was consulted by a man of 26 years who had driven for ten years without getting into trouble with the traffic police, but who had recently been refused a driver's card because of the discovery that he was red-green blind. The ophthalmologist's examination showed an actual dyschromatopsia according to the tests with the Stilling plates. The author decided to make a practical test of the patient's statements as to the accuracy of his driving, accompanying him on a night journey through the center of the city. The patient was always able to state accurately the colors of the street signals, and the author concludes that it is not fair to restrict the examination to the use of opaque colors. A statement by the ophthalmologist that the patient was safe as a driver was returned by the police for a certificate that he was not "daltonic" for the basic colors (yellow, green, and red). The author furnished this certificate and the patient received his driver's card. (References.)

W. H. Crisp.

Rocha, Hilton. **Errors of refraction and constitution.** *Opthalmos*, v. 3, no. 1, pp. 61-158.

Comparison is made between various cranial measurements and the incidence of myopia of varying degrees. The author discusses the old question whether myopia is necessarily pathologic in its origin or represents variation in growth. Extensive quotations from the literature are supplemented by a five-page bibliography. (4 illustrations and numerous tables.)

W. H. Crisp.

Sloane, A. E. **Refraction clinic.** *Amer. Jour. Ophth.*, 1943, v. 26, Jan., pp. 75-78.

Werner, Heinz. **Binocular vision—normal and abnormal.** Arch. of Ophth., 1942, v. 28, Nov., pp. 834-844.

The conceptions of correspondence and disparity are basic in the understanding of retinal binocular stereopsis. The author demonstrates with diagrams and stereoscopic experiments that a dynamic rather than a static, geometric conception of stereopsis is correct. The same factors involved in abnormal retinal relationship are effective in normal binocular vision. The normally occurring functional displacement of binocularly united or diplopic images is definitely related to abnormal projection of retinal points. A change of secondary correspondence and secondary disparity occurs temporarily in normal vision and permanently in abnormal vision. Foveal inhibition serves as one of the abnormal causes of change in correspondence. Primary correspondence may be temporarily lost because of certain stimulus configurations which insure stable unification of disparate images. (11 figures, references.) John C. Long.

Wiltberger, P. B. **Color perception.** Amer. Jour. Ophth., 1943, v. 26, Jan., pp. 78-80.

#### 4

##### OCULAR MOVEMENTS

Argañaraz, Raul. **Nystagmus.** La Semana Med., 1942, v. 49, Nov. 12, pp. 1151-1156.

This is a review of the subject dealing particularly with conjugate deviations and paralysis of associated movements in cerebral diseases. (One drawing, 17 references.) W. H. Crisp.

Cawthorne, T. E., Fitzgerald, G., and Hallpike, C. S. **Studies in human ves-**

tibular function. 2. Observations on the directional preponderance of caloric nystagmus ("Nystagmusbereitschaft") resulting from unilateral labyrinthectomy. Brain, 1942, v. 65, June, p. 138.

Caloric tests in nine patients carried out before and after destruction of one labyrinth for intractable vertigo due to Ménière's disease are reported. After operation there was development of a marked directional preponderance of nystagmus to the side of the intact ear, diminishing with time.

The tonic impulses from the labyrinthine subsidiaries, probably the utricles, are shown to converge upon the vestibular nuclei and are thence relayed to the motor nuclei of the ocular muscles. Cortical impulses derived from the temporal lobes are also integrated within the vestibular nuclei.

Edna M. Reynolds.

Cawthorne, T. E., Fitzgerald, G., and Hallpike, C. S. **Studies in human vestibular function. 3. Observations on the clinical features of "Ménière's" disease, with especial reference to the results of the caloric tests.** Brain, 1942, v. 65, June, p. 161.

The clinical findings in fifty cases of Ménière's disease are analyzed. Loss of cochlear function was observed in all the cases and in 86 percent this loss was bilateral. The deafness was of the internal-ear type in all but two cases. There was no evidence to support the view that tympanic disease or Eustachian obstruction played a significant part in the etiology of Ménière's disease. The caloric reactions showed the presence of a vestibular lesion in 47 out of 50 cases.

Edna M. Reynolds.

Fitzgerald, G., and Hallpike, C. S. **Studies in human vestibular functions. 1. Observations on the directional pre-**

**ponderance ("Nystagmusbereitschaft") of caloric nystagmus resulting from cerebral lesions.** *Brain*, 1942, v. 65, June, p. 115.

Caloric tests to induce labyrinthine nystagmus were carried out upon twenty patients in whom the diagnosis and localization of a cerebral lesion had been well established. In ten cases with lesions of one temporal lobe, directional preponderance of caloric nystagmus was observed to the side of the lesion. In ten cases with lesions which did not involve the temporal lobes, the caloric reactions were normal.

Edna M. Reynolds.

**Gifford, S. R. Transplantation of superior oblique muscle for oculomotor nerve paralysis.** *Arch. of Ophth.*, 1942, v. 28, Nov., p. 882.

The author has utilized the operation of Wiener for the correction of divergence resulting from complete paralysis of the oculomotor nerve. The procedure consists of utilization of the superior oblique muscle as an adductor. The superior oblique is exposed through a cutaneous incision and freed from the pulley. After isolating the muscle well back in the orbit it is brought forward and partially resected. The remaining muscle is then sutured to the sclera at a point about 2 mm. anterior to the insertion of the inferior rectus muscle. Sursumvergence may result from the procedure. If this effect is too troublesome, the condition may be improved by resection and advancement of the paretic inferior rectus muscle. The improvement brought about by superior oblique transplantation is demonstrated on six patients.

John C. Long.

**Lancaster, W. B. Terminology in ocular motility and allied subjects.**

*Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 122-132.

**Lowenstein, O., and Givner, I. Cyclic oculomotor paralysis (spasmus mobilis oculomotorius).** *Arch. of Ophth.*, 1942, v. 28, Nov., pp. 821-823.

A man 32 years of age was observed with ptosis and complete oculomotor paralysis of the left eye. At irregular intervals during the day and occasionally during sleep a peculiar cyclic oculomotor phenomenon appeared. After premonitory twitching of the left lid, the left palpebral fissure opened widely. At the same time the pupil contracted to 3 mm. from its usual size of 8 mm. After twenty seconds the upper lid went slowly down and the pupil dilated again. During this spastic period the refraction became 2 D. more myopic. Detailed neurologic examinations included electroencephalograms and pupillography. The 32 reported cases of this condition are discussed, with various theories of causation. Upon the basis of the findings of pupillography, the authors conclude that the condition is caused by partial destruction of the sphincter nucleus and the hypothalamus. The phenomenon is part of a syndrome due to an extensive hereditary degenerative or postinflammatory process involving the eye-muscle nuclei as well as the basal ganglia. The course is that of a slowly progressive extrapyramidal disease. (6 illustrations, references.)

John C. Long.

**Lyle, T. K. Some cases of post-traumatic diplopia following head injury and their treatment.** *Trans. Ophth. Soc. United Kingdom*, 1941, v. 61, p. 189.

Cases of persistent diplopia following head injury were divided into two classes: those due to paresis of one or more of the extrinsic ocular muscles,

usually based upon injury to the nerve supplying the muscle; and those due to fracture of the orbit with a displacement of the eyeball downward. The muscle involved was usually the superior oblique or the external rectus.

Post-traumatic diplopia necessitates careful investigation to determine in which direction defective ocular movement occurs. Any displacement of the floor of the orbit should be restored early if possible. After four months, if spontaneous recovery has not occurred, surgical treatment of the muscle is indicated.

Beulah Cushman.

Morgan, O. C. **An unusual case of nystagmus.** Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 223.

The patient complained that for the past week objects had moved backward and forward in a horizontal direction as he looked at them. He was a little unsteady when walking, but there was no tinnitus, pain, or headache. On examination the patient had a slight oscillation of the eyes when looking straight ahead. The movement of the disc was synchronous with the pulse rate. The vision was normal and the fundi quite healthy.

The otologist reported a discharging ear, and nystagmus labyrinthine in type, and advised a radical mastoid operation. At operation there was found a fistula from the attic which exposed the external semicircular canal. The nystagmus disappeared promptly.

Beulah Cushman.

O'Connor, Roderic. **Contracture in ocular-muscle paralysis.** Amer. Jour. Ophth., 1943, v. 26, Jan., pp. 69-71.

## 5

### CONJUNCTIVA

Berliner, M. L. **Epidemic keratoconjunctivitis.** Amer. Jour. Ophth., 1943,

v. 26, Jan., pp. 50-53. (5 figures, references.)

Goldberg, S. **Bacillus pyocyaneus infection.** Amer. Jour. Ophth., 1943, v. 26, Jan., p. 78.

Hamburger, Carl. **Blindness and sulfanilic acid.** Schweiz. med. Woch., 1942, v. 72, Jan., p. 196.

Hamburger, formerly of Berlin, now of Geneva, recalls his own work and that of others many years ago concerning the treatment of chronic trachoma with fresh gonorrheal pus. The method, which was applied experimentally to one or two practically blind eyes and produced appreciable improvement in at least one of them, is based upon the Hippocratic principle that an acute disease may conquer a chronic one. Hippocrates is said to have sent patients with chronic joint disease to malarial districts, and the treatment of progressive paralysis with malaria depends upon the same principle.

W. H. Crisp.

Julianelle, L. A., and Smith, J. E. **A statistical analysis of clinical trachoma.** Amer. Jour. Ophth., 1943, v. 26, Feb., pp. 158-166. (5 tables, 3 charts.)

King, E. F. **Four unusual cases of conjunctivitis.** Brit. Jour. Ophth., 1942, v. 26, Oct., pp. 467-473.

Four cases of monocular conjunctivitis which persisted for many months are reported. The pathogenesis of the condition is obscure. Biopsy showed a nonspecific, subacute inflammatory process which in one case resulted in necrosis in the lower fornix with subsequent marked contraction of the conjunctiva. A large number of therapeutic agents were tried without success. Sec-

ondary infection was controlled by sulfonamides. (4 illustrations.)

Edna M. Reynolds.

Laborne Tavares, C. **Constitution and trachoma.** *Ophtalmos*, v. 3, no. 1, pp. 13-61.

This lengthy paper is chiefly devoted to a review of such of the world's literature as bears upon the subject indicated in the author's title. With Angelucci and others the writer believes the lymphatic diathesis has special importance in the genesis of trachoma. (Bibliography of 66 references.)

W. H. Crisp.

Morate, F. H. **Sulfanilamide therapy in trachoma.** *La Semana Med.*, 1942, v. 49, Oct., pp. 1059-1065.

The author has applied the drug sometimes by injection of a 5-percent solution of the sodium salt, with the addition of a local collyrium of this solution. He leans toward preference for a powder of the drug which he obtains by pulverizing in a mortar the usual crystallized form. He has treated 18 cases, mostly of trachoma in various stages. Each of these cases is described in adequate detail.

W. H. Crisp.

Penido Burnier, Jr., **Conjunctival allergy.** *Arquivos do Inst. Penido Burnier*, 1942, v. 6, July, pp. 381-389.

The author discusses the theories of allergy or hypersensitivity, especially in relation to histamine. Three cases are reported. In the first patient the reaction was due to a pollen (*Chrysanthemum leucanthmon*). Three other cases of the same kind have been observed in the Penido Burnier Institute. In the second patient the offending substance appeared to be the dust of the place of employment (coffee warehouse).

The third patient was the author himself. For some time he had experienced in both hands, but chiefly at the extremities of the thumb and index and middle fingers, a dermatitis with moderate edema and exfoliation of the epidermis giving rise to the formation of more or less deep fissures. After trying various ointments, he noticed that his condition improved every time he went away from the city and refrained from his professional activities. Investigating the substances used in his daily practice, it was found that he gave a strongly positive reaction to neotutocaine. The symptoms rapidly disappeared upon avoidance of the offending substance.

Approximately three years after this experience, having in the left eye a moderate catarrhal secretion, the author made use of a collyrium of sulphate of zinc prepared by a São Paulo laboratory and whose formula, as shown on the label, did not mention any anesthetic. After using this collyrium three times, he had symptoms characteristic of an allergic conjunctivitis. A cutaneous test with the collyrium was positive after 24 hours. Two independent chemical analyses of the collyrium showed novocaine or neotutocaine. (The test is based upon the presence of an aminic group, and gives a negative result with cocaine, stovaine, dionin, or holocaine.) In the fourth patient, conjunctivitis followed a splash of the juice from a can of native fruit (camarões) which was opened by the patient. It was impossible to make a control test, because the patient had at once thrown away the preserves.

W. H. Crisp.

Sales, Monteiro. **Bacterioscopy of the conjunctival secretions.** *Arquivos do*

Inst. Penido Burnier, 1942, v. 6, July, pp. 390-414.

The author's study is based upon 5,369 examinations, 2,810 in cases of conjunctivitis, and 2,559 preoperative examinations. In conjunctivitis (in Brazil) the Koch-Weeks bacillus was the most frequent, appearing in 29.3 percent. The author gives statistical analyses, and a review of the literature. He concludes by discussing the positive influence of season and meteorology on the frequency of some bacteria which are found in conjunctivitis. (3 graphs, bibliography of 92 references.)

W. H. Crisp.

Sanders, M., Gulliver, F. D., Forchheimer, L. L., and Alexander, R. C. **Epidemic keratoconjunctivitis.** Jour. Amer. Med. Assoc., 1943, v. 121, Jan. 23, p. 250.

The authors report the clinical, experimental, and epidemiologic data in eighty cases of epidemic keratoconjunctivitis. Forty-two patients had corneal involvement and there was no absorption of corneal opacities after a period of five months. One third of these showed impairment of vision. In addition to the local features there were lymph-node involvement and systemic reactions. Fifty-seven of the patients lost from one to eight weeks from work. In seventy of the cases there was a history of ocular trauma or inflammation. In two of nine attempts a filtrable virus was obtained from conjunctival scrapings, and antibody development was demonstrated in six of 19 cases in which convalescent serum was obtained. The authors believe that this disease is relatively new to the continental United States. (Four tables.)

George H. Stine.

Thakore, M. D. **A case of pterygium.**

Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 121.

A man 35 years of age had a pterygium removed after a conjunctival tear on the nasal side had been repaired. During the operation two eyelashes were found deeply buried in the pterygial fold near the limbus.

Beulah Cushman.

Wood, M. A. **Parinaud's oculoglandular syndrome.** Amer. Jour. Ophth., 1943, v. 26, Feb., pp. 141-145. (2 illustrations, references.)

Zavala, A. C., and Zavala, J. M. **The oculoglandular syndrome of Parinaud.** Anales Argentinos de Oft., 1941, v. 2, Oct.-Nov.-Dec., p. 203.

A 47-year-old laundress presented the clinical picture to which the name of Parinaud is attached. There were no unusual features. A discussion of possible etiology follows. (2 figures.)

Eugene M. Blake.

## 6

### CORNEA AND SCLERA

Anderson, W. A. **Herpetic keratitis.** Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 271.

The author considers the central location of dendritic keratitis and the usual peripheral location of herpes of the cornea. Herpes of the cornea might be due to a lesion of the nerves of the bulbar conjunctiva, and dendritic ulcer to a cracking of the epithelium similar to the changes in Descemet's membrane associated with uveitis.

Beulah Cushman.

Barter, G. A. **Herpetic keratitis.** Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 274.

The author reports on 60 patients, 32

women averaging 40 years of age and 28 men averaging 30 years. Seasonal incidence was concentrated in October-November and February-March. The average duration was four weeks, although in 15 cases the condition lasted from three to five months or longer.

Beulah Cushman.

Berens, Conrad. **Superficial keratectomy.** *Ophth. Ibero-Amer.*, 1942, v. 4, no. 1, pp. 23-24 (in English) and pp. 25-26 (in Portuguese).

The author describes and illustrates his special keratome knife for excision of Bowman's membrane in patients suffering from bullous keratitis. Three cases in which this treatment was applied are briefly described. (2 illustrations.)

W. H. Crisp.

Berliner, M. L. **Epidemic keratoconjunctivitis.** *Amer. Jour. Ophth.*, 1943, v. 26, Jan., pp. 50-53. (5 figures, references.)

Cochran, W., De Vaughn, N. M., and Allen, L. **Corneal vascularization in ariboflavinosis.** *Southern Med. Jour.*, 1942, v. 35, Oct., p. 888.

Photomicrographs of the vascularization in normal and ariboflavinotic human eyes are presented. Human eyes with corneal opacities were not available for injection and photography, but a photomicrograph of the vascularization of a corneal opacity in avitaminotic rats is included. Edna M. Reynolds.

Eckardt, R. E., Stolz, I. H., Adam, A. B., and Johnson, L. V. **The pigment of the Kayser-Fleischer ring.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 151-154. (References.)

Goldberg, S. **Bacillus pyocyaneus infection.** *Amer. Jour. Ophth.*, 1943, v. 26, Jan., p. 78.

Neame, Humphrey. **Dendritic ulceration of the cornea and herpes simplex.** *Trans. Ophth. Soc. United Kingdom*, 1941, v. 61, p. 91. (Illustrations.)

The author reports 22 cases of dendritic ulcer which were seen at clinics. Eleven had a history of facial herpes (herpes simplex), and six had definite evidence of it at some time during their attendance for treatment of the eye. Analysis shows the number of dendritic ulcer patients who have herpes simplex. Individual case histories are given, with details as to recurrences at definite seasons and response to treatment. Hot compresses, atropine, bandage, and general rest were sufficient in many patients. When the ulcer tended to spread or to remain stationary, carbolic acid was used with satisfactory results.

Beulah Cushman.

Penido Burnier, J. **Rodent ulcer of the cornea (Mooren's ulcer).** *Arquivos do Inst. Penido Burnier*, 1942, v. 6, July, pp. 294-305.

Only four such cases have been diagnosed among 102,000 patients in the Penido Burnier clinic. These four cases are described. The first patient was an Italian woman aged 45 years, whose left eye had been enucleated three years earlier after galvanocauterization of the whole cornea for a similar condition. The only part of the right cornea not involved was a central circular zone about 3 mm. in diameter. After unsuccessful preliminary treatment, the cornea was completely covered with a conjunctival flap, a paracentesis having first been performed with the Graefe knife at the lower part of the corneal limbus. Further treatment included the use of foreign protein and a course of tuberculin injections. The eye developed glaucoma, and was subjected to iridectomy. Six months later

the cornea had cleared sufficiently to permit of counting fingers at 3 meters with -4.00 sphere. Seven years after this the crystalline lens had become opaque, but operation was refused.

The second case was associated with acne rosacea of the face, particularly involving the chin, in a woman of forty years. Large superficial ulcers of the cornea were treated by covering with conjunctival flaps, both eyes being involved and one eye being covered by a flap a second time, in addition to the use of paracentesis. Vision was restored to counting fingers at 2 meters in one eye and to 0.1 in the other.

A third woman patient, aged 33 years, was treated with conjunctival flaps and tuberculin therapy. A relapse followed childbirth. After recovery from these later ulcerations, it became necessary to dissect off the adherent conjunctiva from the pupillary area of the cornea.

The author states that only a small proportion of the cases reported in the literature under this heading conform to Mooren's original description. The latter, as quoted by Penido Burnier, describes the disorder as beginning always at the margin of the cornea, advancing along an irregular border, and finally covering the whole corneal surface. Especially characteristic is the narrow grayish line of infiltration which marks the boundary of the unaffected cornea. The healthy cornea preserves its transparency up to the last moment, while the ulcerated area shows development of a dense superficial vascular network. Mooren had never seen hypopyon. But hypopyon occurred in Penido Burnier's second case. It is suggested that there is some confusion in the differential diagnosis between acne rosacea of the cornea and Mooren's ulcer.

Penido Burnier regards simple paracentesis, with puncture and counter-puncture at the limbus and a bridge of cornea between, as just as efficacious as and more harmless than delimiting keratotomy or galvanic fistulization. (4 illustrations, extensive bibliography.)  
W. H. Crisp.

Rea, R. L. **An interesting case of keratitis profunda and its treatment.** Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 117.

The diagnosis was made in regard to a man whose vision became blurred, and who showed a deep interstitial haze but no loss of sensitivity. No definite etiologic factor was found. The best effects seemed to be obtained from the osmotic action of 10-percent magnesium sulphate, using Batten's hydrophthalmoscope, and the ingestion of much lemon juice daily.

Beulah Cushman.

Rosenbaum, H. D. **Varicella and the cornea.** Amer. Jour. Ophth., 1943, v. 26, Jan., pp. 53-56. (One drawing, references.)

Sanders, M., Gulliver, F. D., Rorchheimer, L. L., and Alexander, R. C. **Epidemic keratoconjunctivitis.** Jour. Amer. Med. Assoc., 1943, v. 121, Jan. 23, p. 250. (See Section 5, Conjunctiva.)

Vasquez Barrière, A. **Keratoconus and venereal lymphogranulomatosis.** Ophth. Ibero-Amer., 1942, v. 4, no. 1, pp. 223-232 (in Portuguese) and pp. 233-241 (in English).

The author states that the Frei intradermal test for the systemic disease referred to was positive in 16 cases of keratoconus, 14 of these cases showing an intense reaction. A person with

venereal lymphogranulomatosis had two daughters with keratoconus, each of them presenting a positive Frei test.

W. H. Crisp.

Wise, George. **A case of Bowen's disease of the cornea.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 167-171. (3 illustrations, references.)

## 7

### UVEAL TRACT, SYMPATHETIC DISEASE, AND AQUEOUS HUMOR

Pacheco Luna, R. **Can histolytic endameba produce iritis?** *Guatemala Medica*, 1942, v. 7, Oct. and Nov., pp. 2-3.

The author's personal case was described in 1918 in the *American Journal of Ophthalmology* (volume 1, p. 122). The author lists nine cases of iridocyclitis attributed to this origin, published by five authors between 1918 and 1931.

W. H. Crisp.

Shapira, T. M., and Sitney, J. A. **Choroideremia.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 182-183. (References.)

## 8

### GLAUCOMA AND OCULAR TENSION

Fox, S. A. **Results of glaucoma surgery.** *Amer. Jour. Ophth.*, 1943, v. 26, Jan., pp. 31-49. (6 tables, bibliography.)

Fox, S. A. **Simple posterior sclerotomy and sclerectomy.** *Arch. of Ophth.*, 1942, v. 28, Nov., pp. 802-813.

The author has devised an operation for the control of pressure based on incision or excision of the sclera behind the ciliary body. Several different types of incision into the sclera are described. The incisions are designed so that the choroid can herniate through them and

keep the wound open. An oval sclerectomy is described in which a piece of sclera 10 mm. long and 4 to 5 mm. in width is excised. The choroid is not injured. The bare choroid becomes gradually covered by a thinner, more elastic, tissue which allows an increase in the intraocular volume. Fifteen cases of glaucoma so treated are reported. The work was primarily experimental and was done on eyes that had failed to respond to other forms of treatment. Ten of the eyes had absolute glaucoma. There was an average drop in pressure of 34.6 mm. of mercury but this reduction was not permanent. That there was prolonged relief from pain is evidenced by the fact that none of the eyes was enucleated during the period of observation. Any of the operations described may be useful as a preliminary step to more permanent surgery in eyes whose pressure is too high for surgical safety. (15 case reports, 2 figures, 2 tables, bibliography.) John C. Long.

Martins Rocha, J. **Results of glaucoma surgery.** *Arquivos do Inst. Penido Burnier*, 1942, v. 6, July, pp. 367-380.

From 714 antiglaucomatous operations performed at the Penido Burnier Institute, Campinas, Brazil, the author selects for review 94 cases which could be followed for a minimum of two and a maximum of 16 years. The 35 cases of acute glaucoma were treated by iridectomy, and the results in these cases indicated the importance of early action. Of the 59 cases of chronic glaucoma, 34 were dealt with by trephining, 22 by the Lagrange iridosclerectomy, and 3 by cyclodialysis. The results from the Elliot averaged only slightly better than those from the Lagrange operation. Surgically, the result was good in 79.4 percent of the former and

68.1 percent of the latter. (Statistical tables, visual fields.) W. H. Crisp.

Queiroga, Geraldo. **Irido-sclerecto-cyclodialysis.** *Ophthalmos*, v. 3, no. 1, pp. 159-163.

Beneath the conjunctival flap, the author first excises a strip of sclera about 3 mm. long and lying near the limbus. He then through the opening in the sclera performs a cyclodialysis extending about 10 mm. in various directions. The conjunctival wound is closed with an untied suture. Of 41 eyes on which this operation was performed, 16 had simple glaucoma, 5 had secondary glaucoma, 4 irritative chronic glaucoma, 4 atrophy of the optic nerve, 3 acute glaucoma, and 2 staphyloma. Good results appear to have been obtained. (5 drawings.) W. H. Crisp.

Randolph, M. E. **A new cyclodialysis instrument.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., p. 187. (One illustration.)

Smith, Virginia. **Administrative problems of eye clinics in caring for glaucoma patients.** *Sight-Saving Review*, 1942, v. 12, Sept., p. 182. (See Section 18, Hygiene, sociology, education, and history.)

Terrizzano, M. F., and Terrizzona, A. M. M. **Roentgen therapy of glaucoma.** *La Semana Med.*, 1942, v. 49, pp. 1354-1356.

The authors recall a paper in which Satanowsky, in 1936 (*Amer. Jour. of Ophth.*, 1939, v. 22, p. 228), reported relief of absolute glaucoma by the use of roentgen therapy. Satanowsky's patient received four treatments of 18 roentgens each, at intervals of one week.

The present writers have treated ten cases of glaucoma with roentgen rays.

One patient had traumatic glaucoma, six had painful chronic glaucoma, two had hemorrhagic glaucoma, and one had glaucoma associated with hypertensive iritis. All of these cases were improved, with disappearance of pain and lacrimation. The authors do not sufficiently establish their diagnoses, and particularly do not indicate whether the usual forms of antiglaucomatous treatment were employed. One of the only two cases in which clinical details are given was obviously suffering from iritis which was improved under atropine. The X-ray dose mentioned is described by the following details: Tensions of 70 to 90 and 140 kv., with 2, 5, and 10 ma., filtered with 1 and 3 of Al and for 140 kv. with 0.25 mm. of Cu. and 1 mm. of Al; the dose being of 100 to 270 roentgens in one session weekly, in series as long as six weeks.

W. H. Crisp.

## 9

### CRYSTALLINE LENS

Almeida Revoucas, Jose de. **Capsulolenticular extraction, without mydriasis.** *Arquivos Brasileiros de Oft.*, 1942, v. 5, Oct., pp. 223-236.

The technique now employed by the author is based upon experience with two hundred cases. He believes that injection of the superior rectus presents more disadvantages than advantages. He makes the limbal incision with a knife from the ten o'clock to the two o'clock position, and enlarges with scissors. Extracted lenses are preserved in a 0.50 percent solution of carbolic acid. An accumulated supply of twenty lenses is disintegrated in the laboratory, the preparation filtered through gauze, and divided into ampoules of 2 c.c., which are sterilized by heat. From these ampoules, subcutaneous injection

tions of 0.50, 1.00, and 1.50 c.c. are given on alternate days in cases of rupture of the capsule. By this means the author believes he has avoided or shortened the phacoanaphylactic reaction. Good results have been obtained in a number of cases without mydriasis. Thirteen cases are reported in detail. (Bibliography.) W. H. Crisp.

Krishnamurty, K. **Treatment of immature cataract.** *Indian Med. Jour.*, 1942, v. 36, Aug., p. 193.

The author claims to have found improvement in vision and appreciable disappearance of the striae in the lens from the use of the following dietary régime and local use of an ointment: diet including hand-pounded or semi-polished rice, two or three fresh lime-fruits, 1 ounce of yeast and 3 or 4 tablets of vitamin-C daily; local treatment, application of an ointment of calcium chloride and iodide with massage for five minutes, night and morning.

Edna M. Reynolds.

Torres Estrada, Antonio. **The suture in the cataract operation.** *Bol. del Hosp. Oft. de Ntra. Sra. de la Luz*, 1941, v. 1, July-Aug.-Sept.-Oct., pp. 229-247.

After preliminary discussion, the author reviews the history of sutures in cataract extraction, including particularly the sutures of Williams, Suarez de Mendoza, Kalt, Gómez Márquez, Liégard, Olmos, Nugent, and Van Lint. He himself uses two Liégard sutures (mattress sutures of cornea and sclera), one between the ten and eleven o'clock positions, and the other between the one and two o'clock positions. He extracts beneath a conjunctival bridge. (20 illustrations.)

W. H. Crisp.

## 10

### RETINA AND VITREOUS

Almeida, A. **Retinal lipoidosis.** *Arquivos do Inst. Penido Burnier*, 1942, v. 6, July, pp. 350-356.

A woman aged 44 years had an area of fatty infiltration in the macular region of each eye, and a juxtapapillary infiltration in the right eye. She had hypophyseal infantilism accompanied by hypothyroidism, with basal metabolism of minus 23.5 percent. The blood at first showed 3.2 gm. per 100 c.c., but on a fat-free diet the proportion fell to 1.93 gm. per 100 c.c. (2 color drawings, 2 fundus photographs, references.) W. H. Crisp.

Bloch, F. J. **Retinopathy in juvenile diabetes mellitus.** *Arch. of Ophth.*, 1942, v. 28, Nov., p. 891.

Two cases of retinal changes in juvenile diabetes are reported, one in a woman of 26 and another in a woman of 37 years. In neither case was the blood pressure abnormal nor was there any evidence of renal disease. The author quotes extensively from the literature to indicate the confusion existing as to the occurrence of true diabetic retinopathy. The optic nerve and the macular region, especially, show marked differences between the fundus changes of arteriosclerosis, hypertension, and diabetes. There are a number of cases of retinal changes in juvenile diabetics that suggest that diabetes itself, rather than renal or arteriosclerotic changes, is responsible for the changes observed. There is need for study of a new series of juvenile diabetics, as the older reports do not contain adequate descriptions of the vascular and renal conditions.

John C. Long.

Greeves, R. A. **Macular edema.** Trans. Ophth. Soc. United Kingdom, 1941, v. 61, p. 5.

As a factor in macular edema, the author discusses a vascular disturbance in which the two sets of blood vessels (choroidal and retinal) supplying the retina are involved. Edema of the macula is always accompanied by deterioration of central vision, distortion of straight lines, or a sense of diminution in the size of objects. The clinical signs are loss of retinal transparency and sometimes a faint circular light reflex.

The vision may be restored, may be permanently reduced, or may be completely destroyed. The ophthalmoscopic appearance of the macula may return to normal, but some permanent pigmentary disturbance can often be seen. If an alteration in the apparent size of objects persists it takes the form of permanent micropsia.

The author's first group includes those cases which are due to inflammatory vascular changes in the choroid. Eleven cases are given, and are compared with the condition described by several Japanese authors as "retinitis centralis serosa."

Another cause of macular edema is the obstruction of retinal vessels. Involvement of nasal branches usually causes no permanent visual loss, whereas with involvement of the temporal branches the visual loss depends on the size and location of the thrombosis. The thrombosis shows great variety, depending on the nature and behavior of the obstructing clot. The lumen of the vein may be completely and permanently obstructed, or may be completely closed but with the clot shrinking quickly, or it may be canalized, or finally the obstruction may be incomplete from the start. The author

has never found heparin to be of value in clots already formed. He adds a discussion of retinal edema in albuminuric, diabetic, and arteriosclerotic retinitis, in commotio retinae, and in iridocyclitis. Beulah Cushman.

McGovern, F. H. **Angiomatosis retinae.** Amer. Jour. Ophth., 1943, v. 26, Feb., pp. 184-187. (4 photomicrographs, references.)

Meyer, Correa. **Retinal cyst.** Arquivos do Inst. Penido Burnier, 1942, v. 6, July, pp. 281-293.

The cyst was encountered in a white Brazilian student aged twenty years. It was located in the inferotemporal quadrant of the left eye, and had the characteristics described by Weve, being more or less spherical, with smooth walls, tense, fixed to the retinal wall and translucent. The eye was myopic. Twelve years earlier this eye had been operated upon for removal of a foreign body which had lodged in the sclera near the limbus. The vision of the eye with correction was barely one third of normal, while the other eye possessed normal vision with correction. Each eye showed a myopic conus, and the left eye had areas of choroidal atrophy near the disc. The cyst lay back of the equator in a large depigmented area of the retina. The literature of the subject is reviewed. (3 color drawings, 2 fundus photographs, visual field.) W. H. Crisp.

Parikh, M. K. **Aspiration in eye diseases.** Indian Med. Jour., 1942, v. 36, July, p. 175.

Aspiration of the vitreous is recommended prior to cataract extraction in patients with prominent eyeballs, in glaucoma of any type, in iritis, in trau-

matic vitreous bleeding seen as hemorrhagic opacity, and in vitreous opacities other than hemorrhagic. The technique of aspiration of the vitreous is described and its contraindications and complications are listed. Edna M. Reynolds.

Schwarz, G. T. **Case report of congenital grouped pigmentation of the retina with maculocerebral degeneration.** *Amer. Jour. Opth.*, 1943, v. 26, Jan., pp. 72-94. (References.)

Vail, D., and Strong, J. C., Jr. **Chorioretinitis associated with positive serologic tests for toxoplasma in older children and adults.** *Amer. Jour. Opth.*, 1943, v. 26, Feb., pp. 133-141. (Bibliography.)

Williamson-Noble, F. A. **Open holes in the retina.** *Trans. Opth. Soc. United Kingdom*, 1941, v. 61, p. 129.

The author reports three cases of open hole in the lower retina, with partial separation. In each case the author decided that operative interference should not be attempted. Each patient maintained vision of 6/6, and the separations did not extend. The age and physical condition of one patient were such as to contraindicate operation. The second patient had had an unsuccessful operation on the other eye three years previously, and when the vision in the remaining eye was reduced this eye was found to have a peripheral hole temporally with partial separation. Bed rest was advised for a period of a month, and six months later, with some change in vision, the patient was put to bed for another three weeks. Two years later the peripheral portion of the retina remained unaltered.

The third patient, 24 years of age, had normal vision, but a small detachment was present down and out, with

peripheral disinsertion of the retina. After two weeks of continuing his military work on a reduced scale the appearance remained the same. The patient was able to continue taking things quietly for another month, and the appearance of the retina still remained the same. The patient was then advised to resume his regular activity. He was seen again several months later, when the condition had not changed.

The author concludes that the presence of a hole with only a small peripheral loss of the visual field and no interference with central vision did not constitute an indication for immediate operation, particularly during war time. Beulah Cushman.

## 11

### OPTIC NERVE AND TOXIC AMBLYOPIAS

Benedict, W. L. **Multiple sclerosis as an etiologic factor in retrobulbar neuritis.** *Arch. of Opth.*, 1942, v. 28, Dec., pp. 988-995.

Retrobulbar neuritis is often the first symptom of multiple sclerosis and may occur years before other symptoms develop. Of five hundred cases of definitely proved multiple sclerosis at the Mayo Clinic, disturbance in vision was the first symptom in 15 percent. In an additional 40 percent visual disturbance occurred some time in the course of the disease. Typically an attack of retrobulbar neuritis resulting from multiple sclerosis is preceded a day or two by dizziness which may be accompanied by vomiting. In most instances there is gradual decrease in vision until by the end of the third or fourth day there is no perception of light. After 24 to 48 hours of blindness there is gradual partial restoration of vision. Pain in the

eye, especially on motion, is observed in about one half of the cases. More than 400 cases of retrobulbar neuritis were reviewed. Of this number, after excluding other likely causes, a diagnosis of multiple sclerosis was made in ninety. In 41 of these ninety cases further evidence of the disease has appeared. In none of the ninety patients have other explanations for the neuritis become manifest. The author states that in the absence of signs or symptoms of other causes of retrobulbar neuritis it would be reasonable to presume that the condition is due to multiple sclerosis even though this cannot be otherwise substantiated. (References.)

John C. Long.

Halbron, Pierre. **Retrobulbar optic neuritis and its sinus origin.** *Arquivos Brasileiros de Oft.*, 1942, v. 5, Oct., pp. 207-223.

The author emphasizes the uncertainties which usually surround the diagnosis and treatment of a retrobulbar neuritis as due to disease of the nasal sinuses. The difficulty arises particularly with regard to latent non-suppurative sinusitis. Two cases are reported. A man of 27 years had had complete bilateral amaurosis for three days. He had had frequent frontal headaches for the past seven months. The eyes showed papillary edema, dilatation of pupils, and pain on pressure upon the eyeballs. A rhinologist found the sinuses normal and prescribed ephedrine without result. Radiography showed the sinuses normal. Nevertheless, it was decided to open the ethmoids and sphenoids. All that could be said as to the operative findings was that the ethmoids were friable and that the mucosa of the ethmoidal cells seemed to be thickened. No nasal packing was used. Next night the pa-

tient had an abundant hemorrhage, and the following day the headache had disappeared. In the meantime the patient was given daily injections of cyanide of mercury. The vision slowly improved. After two weeks the right eye had  $1/3$  visual acuity, but the left eye could only count fingers at 50 centimeters. One month after the operation the vision had risen to  $2/3$  in each eye. When the patient was seen again 11 months later, his visual acuity was normal, and he had had no more headache.

The second case was that of a patient aged 25 years who came on account of neuralgic pains and diminished vision, right  $2/10$ , left  $4/10$ . The nose examination showed normal conditions. Radiography revealed excavation of the sella turcica. It was decided to try anesthetizing both middle turbinates with Bonain's solution (cocaine, carbolic acid, and menthol). Next day the visual acuity had risen to right  $3/10$ , left  $5/10$ . The treatment was repeated daily, and after the third application the vision had risen to  $9/10$  for each eye.

Various theories are discussed by the author. Cases of this kind encountered in a clinic are seldom kept under observation for a sufficient length of time. A disorder of the central nervous system may be found later, but the cause of the immediate benefit derived at times from opening of the sinuses remains a mystery. W. H. Crisp.

Leinfelder, P. J., and Paul, W. D. **Papilledema in general disease.** *Arch. of Ophth.*, 1942, v. 28, Dec., pp. 983-988.

Neuroretinitis associated with general disease is often accompanied by an increase in intracranial pressure. The papilledema and increased intracranial pressure probably result from a change

in the brain tissue incident to the general disease rather than as an effect of a primary neoplasm of the brain. Patients with hypertensive vascular disease, nephritis, diabetes, leukemia, anemia, and arteriosclerosis, all showing ophthalmoscopic evidences of the general disease, were subjected to spinal-fluid-pressure determinations. All the patients without papilledema had an intrathecal pressure of less than 200 mm. of water. Of 17 patients with papilledema, 15 showed elevation of the intracranial pressure above the upper limit of normal. One of the patients with papilledema but with normal intrathecal pressure showed a generalized retinal edema. Post-mortem material suggests that edema of the brain is responsible for the increased intracranial pressure and that the degree of edema is reflected in the rise of pressure, which is indicated by papilledema. (3 tables, references.)

John C. Long.

Ravin, L. C. **Treatment of acute optic neuritis with vasodilators.** *Amer. Jour. Ophth.*, 1943, v. 26, Feb., pp. 188-190. (References.)

## 12

### VISUAL TRACTS AND CENTERS

Bender, M. B., and Wechsler, I. S. **Irregular and multiple homonymous visual-field defects.** *Arch. of Ophth.*, 1942, Nov., v. 28, pp. 904-912.

Three cases of bilateral homonymous field defect of sudden onset are reported in considerable detail. As all of the patients survived, examinations of the brain could not be made, but it was thought from the fields and other visual symptoms that the lesions were in

the calcarine cortex of the occipital lobe. Absence of optic-nerve atrophy or pupillary disturbances indicates a location behind the pathway to the geniculate bodies. The lesions could have been either in the optic radiation or in the cortex, but concomitant visual symptoms, sudden onset, and so on seem to indicate involvement of the occipital cortex.

John C. Long.

Hines, Marion. **Recent contributions to localization of vision in the central nervous system.** *Arch. of Ophth.*, 1942, v. 28, Nov., p. 913.

This is a detailed discussion of some of the recent discoveries in localization of the visual areas of the brain in man and animals. Among the conclusions, it is stated that homonymous retinal half-fields are projected in an orderly manner on the ipsilateral geniculate body and within the area striata, the greater part of each region being reserved for central vision. There has been no adequate explanation for bilateral representation of macular vision. In man a lesion of the lateral geniculate body or of the area striata produces a loss of visual sensations without loss of visual memory or visual orientation. Lesions of the remainder of the occipital lobe produce at least one of four types of visual disorientation.

It is thought that, in the future further collaboration between the neurosurgeon and the ophthalmologist will fill gaps in our present knowledge. The development of electrophysiology has necessitated new anatomic studies and it has become apparent that a satisfactory understanding of vision cannot be obtained from anatomic studies alone.

John C. Long.

## PAN-AMERICAN NOTES

Edited by DR. M. URIBE TRONCOSO  
500 West End Avenue, New York

Communications should reach the Editor by the twelfth of the month

### MISCELLANEOUS

*Pan-American Congress of Ophthalmology* has suffered a great loss in the death of Dr. Edward Jackson of Denver, and of Dr. Hanford McKee of Montreal. The Executive Committee of the Congress at a recent meeting appointed Dr. Frederick Cordes of San Francisco and Dr. John A. MacMillan of Montreal to fill the places made vacant.

*Pan-American Congress of Ophthalmology.* The plans for this Congress have been formulated and appear in an attractive program containing a letter addressed to ophthalmologists who might wish to attend this meeting, to be held in Montevideo, Uruguay, and signed by the president, Dr. Harry S. Gradle. Excerpts from this letter read as follows:

"During the past year the Pan-American Congress of Ophthalmology has progressed in all aspects of the work initiated at the first meeting in 1940. You have undoubtedly received at least one copy of *Ophthalmologia Ibero-Americana*, the official organ of the Congress (at least two issues were sunk in transit from Brazil to the United States). Your officers of the Congress are proud of this publication and believe that it forms an important highway for the exchange of scientific knowledge between all of the Americas. As you know, *Ophthalmologia Ibero-Americana* is sent gratis to all paid-up members of the Congress.

"The program for the 1943 meeting is being arranged by an international committee consisting of Dr. Berens of New York, Dr. Alvaro of São Paulo, Brazil, Prof. Vazquez-Barriere of Montevideo, and Prof. Carlos Charlin of Santiago, Chile."

The program consists of an inaugural session set for the first day, November 4th; Social ophthalmology, November 5th, which includes a morning program on "Prevention of blindness in the Americas" and an afternoon session on "The status of trachoma in the Americas." Research in ophthalmology will be considered on Saturday, November 6th; the next day will be given over to excursions and festivities; and the last day, November 8th, to Medical ophthalmology; namely, a discussion of glaucoma, as follows: 1. The preglaucomatous state—its diagnosis and treatment. 2. New ideas on glaucoma derived from gonioscopy. 3. Estimation and mechanism of the destructive effects of ocular hypertension. 4. Surgical intervention in glaucoma—how far can medical treatment be continued?

The plan is to proceed with the organization and preparation of scientific work for the meeting, but if by June, 1943, the world situation still seems unfavorable, the meeting will be postponed until November, 1944.

*Brazilian National Council of Ophthalmology.* The issue of *Arquivos do Instituto Penido Burnier* for July, 1942, gives details regarding the formation of the Brazilian National Council of Ophthalmology, created by unanimous decision of the Fourth Brazilian Congress of Ophthalmology, Rio de Janeiro, July, 1941. The Council is made up of the professors of ophthalmology in the various faculties of medicine, of the instructors (*liberdocentes*) in the same departments, and of the presidents of the ophthalmological societies existing in the country. The purposes of the Council are stated to be to improve the teaching of the specialty to those who desire to practice ophthalmology, to increase the proficiency of those who wish to submit themselves to its tests in order to obtain the corresponding certificate, and to use all means for the progress of ophthalmology. Regulations have been drawn up. The Council will be controlled by a Central Executive Commission, with headquarters in the capital of the country, and represented by regional commissions in the cities in which there are faculties of medicine. The Council's examinations will be held in June of each year. Candidates will be required to have practiced their specialty for more than two years, to have published works on ophthalmology, to have sent to the Council at least 20 personal observations of various ophthalmological cases, to have been approved upon written examination before a regional commission but judged by a commission appointed by the Central Executive Commission, and to have passed an oral and practical test before the Central Executive Commission or a regional commission.

*Archivos de Oftalmologia de Buenos Aires.* The August, 1942, number of this journal contained the following articles: Surgical treatment of vertical strabismus with torticollis, Prof. Raul Argañaraz; Postoperative results in chronic glaucoma, Drs. C. Espildora Luque and V. A. Schweitzer; Leprous tuberculous reaction of the lids, Drs. Jose M. M. Fernandez and Maximo Carlos Soto; Contribution to the study of substances which modify the circulation and tension of the eyes, Prof. G. Von Grolman and Dr. Estaban Angel; Cinemato-

graphic record of the double pulse in the retina, Drs. Justo Lijo Pavia and Federico C. Cerboni; Secondary glaucoma by epithelial penetration, Drs. Carlos S. Samel and Julio Arouh; A practical substitute of homatropine for the examination of the fundus of the eye and refraction, atropine by catalysis, Dr. Lorenzo S. Pereyra.

*Revista Oto Neuro Oftalmologica y de Cirugia Neurológica Sud Americana*, Buenos Aires. The October, 1942, number of this journal contained the following articles: Ocular traumatology and the war, Dr. Olga Sitchevskaya; and Detachment of the retina and cyst after reapplication, Dr. J. Lijo Pavia.

*Arquivos do Instituto Penido Burnier*, São Paulo. The July, 1942, number of this journal contained the following articles: In memoriam, Prof. Santo Cecilia; Cyst of the retina, Pericystic pigmentary changes in the retina (pericystic retinitis), Dr. Correa Meyer; Ulcus cornea rodens, Dr. J. Penido Burnier; Compensation for injuries in the eyes, Dr. P. Cezar Pimental e Lech, Jr.; Lipoidosis retinae, Dr. A. de Almeida; Retinal tumors in children, Drs. Souza Queiroz and Monteiro Sales; Surgical results in glaucoma, Dr. J. Martins Rocha; Conjunctival allergy, Dr. F. Penido Burnier; Bacterioscopy of the conjunctival secretion, Dr. Monteiro Sales.

#### SOCIETIES

A delegation of the Argentine Society of Ophthalmology, invited by the Society of Oph-

thalmology and Otolaryngology and the Medical Faculty of Asunción, Paraguay, made a trip to that country in August, 1942, to attend an ophthalmological meeting held in their honor. The following papers were presented at the meeting: The optical pathway, Prof. Jorge Malbran; Diagnosis of intraocular tumors, Dr. Carlos Damel; A contribution to the casuistic of the phenomena of Marcus Gunn, Prof. J. M. Vila Ortiz; Injuries of the cornea of obstetrical origin, Dr. Juan A. Gallino; Course of the homolateral superior optical fibers in the cat (experimental), Drs. F. Vidal and Jorge Malbran; What is the cost of negligence in ocular injuries in industry? Dr. J. M. Vila Ortiz; X-ray treatment in ophthalmological lesions, Drs. B. J. Tiscornia and Raul Moret; Fold in the retina, Dr. J. Remonda.

#### PERSONAL

Prof. Lorenzo Bardelli died in Florence, Italy, in October, 1942. He was one of the most distinguished and well-known ophthalmologists in Italy. Dean of the Faculty of Medicine in Florence University, and Director of the Eye Clinic, he transformed the latter into a magnificent institute with all modern and scientific conveniences. He was a most respected teacher, and through his clinic passed numerous physicians who became well-known specialists. An excellent surgeon and prolific writer, he was for many years editor of the "Bolletino d'Oculistica." Three years ago he retired from the University and as a homage to his merits the Italian Society of Ophthalmology made his clinic the place for its annual meeting.

## NEWS ITEMS

Edited by DR. RALPH H. MILLER  
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News items should reach the editor by the twelfth of the month

#### DEATHS

Dr. Joseph Charles Kelly, Boston, Massachusetts, died December 17, 1942, aged 33 years.

Dr. Reed Madden, Xenia, Ohio, died December 26, 1942, aged 72 years.

Dr. Frank Tornholm, Wahoo, Nebraska, died November 10, 1942, aged 72 years.

Dr. James Buchanan Wallace, Saline, Michigan, died December 4, 1942, aged 78 years.

Dr. Frank E. Detling, Los Angeles, California, died December 25, 1942, aged 66 years.

Dr. Joseph F. Duane, Peoria, Illinois, died January 21, 1943, aged 62 years.

Dr. Joseph William Browning, Exeter, Ontario, Canada, died December 20, 1942, aged 99 years.

Dr. Frank Samuel Lovering, Moultonboro, New Hampshire, died December 25, 1942, aged 81 years.

Lieutenant Commander Frank K. Moss, United States Navy, formerly of General Electric Laboratories, Nela Park, Cleveland, Ohio, died recently, aged 45 years.

Dr. Erwin A. Beard, Inglewood, California, died January 4, 1943, aged 72 years.

Dr. Francis J. Coleman, Kuna, Idaho, died January 2, 1943, aged 74 years.

Dr. John P. Cooney, Providence, Rhode Island, died January 15, 1943, aged 72 years.

Dr. J. Frank Huss, Atlanta, Georgia, died January 9, 1943, aged 71 years.

Dr. Horace W. Kohler, Red Lion, Pennsylvania, died January 4, 1943, aged 51 years.

Dr. Charles Shattinger, Los Altos, California, died December 13, 1942, aged 77 years.

#### MISCELLANEOUS

The American Board of Ophthalmology has

announced that 1943 examinations will be held in New York City on June 4th and 5th, and in Chicago on October 8th and 9th. Candidates will be required to appear for examination on two successive days. Application blanks may be obtained from Dr. John Green, Secretary, 6830 Waterman Avenue, Saint Louis, Missouri.

The next examination by the American Orthoptic Council will be held in September-October, 1943.

The written examinations will be held at various cities in the country on September 9th. Only those passing the written examinations will be permitted to take the oral and practical tests, to be given in Chicago, October 9th.

Applications on official forms must be received before August 1, 1943.

Address the American Orthoptic Council, 23 East 79th Street, New York, New York.

**War Conference.**—The medical, surgical, and industrial hygiene experts, who are so ably safeguarding the well-being of more than 20 million industrial workers, have agreed to pool their knowledge and exchange their experiences regarding the many new and complex problems of today's wartime production. For this purpose their organizations—The American Association of Industrial Physicians and Surgeons, The American Industrial Hygiene Association, and The National Conference of Governmental Hygienists—are combining their annual meetings in a four-day "War conference" at Rochester, New York, May 24 to 27, 1943. Among the problems to be discussed are: The mass entry of women into industry; Older-age employees, with their various associated problems; Proper placement and employability considerations of the 4F rejectees; Rehabilitation and proper employment of those already discharged from the military services because of disabling conditions; Toxic and other hazards from new substances, new processes, and the use of substitute materials; Absenteeism; Fatigue; Nutrition; Effects of long hours, double shifts, two-job workers, overtime, increased accident rates; Advances in the treatment of illnesses and injuries; and many others.

Physicians and surgeons, hygienists, engineers, nurses, executives—all who are interested in the problems of industrial health and their solution—are invited to be present at as many of the sessions as they can arrange to attend; no registration fee is required.

#### SOCIETIES

The seventy-ninth annual meeting of the American Ophthalmological Society will be held at the Homestead, Hot Springs, Virginia, on May 31st and June 1st and 2d.

The Los Angeles Society of Ophthalmology

and Otolaryngology appointed the following officers for 1943: Dr. Sylvester H. Welsh, president; Dr. M. E. Trainor, vice-president; Dr. Orrie E. Ghrist, secretary-treasurer; and Dr. Isaac H. Jones, committeeman. The Society meets at the Los Angeles County Medical Association Building, Los Angeles, on the fourth Monday of each month from September to May, inclusive.

At the seventh annual New Orleans Graduate Medical Assembly, held at the Roosevelt Hotel, March 15th to 18th, a program of lectures, clinics, symposiums, clinicopathologic conferences, scientific and technical exhibits, medical motion pictures, and round-table discussions was presented. Among the guest speakers was Dr. Ralph I. Lloyd of Brooklyn.

At the conference on industrial health, sponsored by the Indiana State Medical Association, Dr. Edmond O. Alvis presented a paper on "Essentials on first aid and later management of industrial eye injuries" in the symposium on industrial injuries.

The eighteenth meeting of the Reading Eye, Ear, Nose, and Throat Society was held in Philadelphia, on Wednesday, February 17, 1943. The Eye Section attended operative clinics and made ward rounds at Wills Hospital. Both sections joined in a lecture by Dr. Perce DeLong on the "Pathology of uveitis," illustrated by microscopic slides. Following dinner the members attended the joint meeting of the Section of Otolaryngology of the College of Physicians and the Philadelphia Laryngological Society.

#### PERSONALS

Dr. J. R. Walker of Fresno, California, was recently appointed to the State Board of Medical Examiners by Governor Earl Warren to succeed Dr. William Swim of Los Angeles, whose term expired. Dr. Walker has been located in Fresno, practicing ophthalmology, since 1901.

Dr. Walter Stevenson of Quincy, Illinois, announces that his practice is now limited to ophthalmology.

Dr. A. D. Frost, Professor of Ophthalmology at Ohio State University, was the guest speaker at the February meeting of the Cleveland Ophthalmological Club. His subject was "Optic neuritis."

Dr. Warren D. Horner of San Francisco has been on active duty at the United States Naval Hospital, Pearl Harbor, Hawaii, since January, 1942. He has recently been promoted from commander to captain.